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JNAH publishes original research in the field of Nursing and Allied Health Sciences especially; Physical Therapy, Imaging Technology, Laboratory Technology, Orthotics & Prosthetics, Optometry & Orthoptics, Nursing and many more which provides sufficient contribution to Medical knowledge.
Incomplete studies are discouraged.

OBJECTIVES

1. To publish original, well documented, peer-reviewed manuscripts related to the field of Allied Health Sciences and Nursing
2. To provide a distinguished platform that bridges the realms of Allied Health Sciences and Nursing, promoting interdisciplinary collaboration, knowledge dissemination, and scholarly discourse.
3. To accelerate the progression of these fields by showcasing pioneering research, evidence-based practices, and transformative ideas.
4. To achieve a high level of ethical medical & allied health sciences journalism.
5. To produce credible & authentic publication.

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Editorial

Need for Research Momentum in Allied Health Professionals

Misbah Marryam [1]

Benazir Bhutto Hospital, Rawalpindi,[1]

In the ever-evolving landscape of healthcare, Allied Health Professionals play a pivotal role in patient care, rehabilitation, and overall wellness. These services constitute a foundational pillar of healthcare systems worldwide, comprising approximately one-third of the global health workforce including a wide range of healthcare disciplines like physiotherapy, speech therapy, occupational therapy, podiatry, psychology, dietetics, pharmacy, prosthetics, orthotics, orthoptics, radiology and exercise physiology, etc. They not only manage patients with different impairments and disabilities at different levels but also play a major role in filling the gap between different professions by fostering a multi-disciplinary team approach.[1]

The cardinal foundation of any healthcare system is research. As we navigate the complexities of the current era, it is important to underscore the significance of research promotion in advancing the field of Allied Health. Healthcare organizations that focus on research not only deliver superior health services but also cultivate an environment conducive to staff development.[2]

Despite having the integral nature of roles, the research output in the Allied Health domain often pales in comparison to that of other healthcare sectors. This discrepancy not only hinders professional growth but also impedes the development of evidence-based practices that could significantly enhance patient outcomes. Research in Allied Health is not merely an academic pursuit; it is the driving force behind innovation, improved patient care, and the development of effective interventions. As with time, we have witnessed an increasing trend of evidence-based practice all over the world, besides doctors and nurses, thus Allied health professionals are also encouraged to participate in research.[1] There are multiple benefits to investing time in research for Allied Health professionals. It will help them to explore new frontiers, challenge existing paradigms, and contribute to the ever-expanding body of knowledge in healthcare. At a clinician level, it will include positive attitudes towards research, enhanced uptake of evidence from research and its transformation into practice, and the development of critical thinking skills thus breaking the status quo. At a service level, allied health professionals who are active in research may transform the infrastructure and client care in an upgrading manner that could also affect the policy-making for the improvement of healthcare organizations. Therefore, it is very important for allied health professionals to participate in research as the lack of research evidence for interventions provided by allied health professionals poses a challenge, risking their contributions being overshadowed by more traditionally dominant healthcare professions depriving them of the deserved positions, and expansion of their scope of practice.[3]

Despite the increasing interest among allied health professionals in research, there are several barriers including time constraints, limited funding, competing priorities in clinical settings, inadequate research skills, and a lack of support from both higher authorities and colleagues. Other factors that play a huge role are ; the lack of confidence in presenting ideas before ethical committees, competitive writing to make them publishable in esteemed journals along with discussing ideas with seniors. All this happens as allied health professionals have only basic knowledge of research at the undergraduate level and at higher levels, they have a lack of support from organizations as well as inefficient mentoring for research.[4]

To promote a positive research culture for Allied health professionals, all these issues need to be resolved starting with certain initiatives like incorporating research into undergraduate studies, mandating research during the initial post-graduation training, conducting workshops, and providing organizational support for research endeavors. Furthermore, introducing specific research positions within healthcare organizations, such as “research facilitator”, “research fellow”, “research lead” or “clinical academics” can also play a vital role. These positions can be funded solely by a healthcare organization or in partnership with a university. However, they should be part of a healthcare setting rather than exclusively working within a university or

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institution. Individuals recruited in these positions can help in providing academic support to the clinicians and their teams along with the development of their own research projects. There could be a positive impact from research positions as reported by literature in terms of enhanced individual research skills, increased participation in research projects as well and research-based clinical results for improvement of patient care. Research can furthermore be linked at the organizational level with education, professional development, service improvement, and practice development activities. A positive attitude along with increased motivation can be generated in clinicians who are involved in research by providing time-to-time feedback in the form of appraisal to researchers in different forms.[5]

References:

1. Slade SC, Philip K, Morris ME. Frameworks for embedding a research culture in allied health practice: a rapid review. Health research policy and systems. 2018;16:1-15.

2. Comer C, Collings R, McCracken A, Payne C, Moore A. Allied Health Professionals' Perceptions of Research in the United Kingdom National Health Service: a survey of research capacity and culture. BMC Health Services Research. 2022;22(1):1094.

3. Matus J, Walker A, Mickan S. Research capacity building frameworks for allied health professionals–a systematic review. BMC Health Services Research. 2018;18(1):1-11.

4. Alison JA, Zafiropoulos B, Heard R. Key factors influencing allied health research capacity in a large Australian metropolitan health district. Journal of multidisciplinary healthcare. 2017:277-91.

5. Wenke R, Mickan S. The role and impact of research positions within health care settings in allied health: a systematic review. BMC Health Services Research. 2016;16(1):1-10.

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Original Article

Effects of Sleeper stretch and Mobilization with movement in patients with adhesive capsulitis: A randomized control trial

Kiran Azam khan [1], Maria Khalid[2]

Abstract

Objective: To determine the effects of Mobilization with movement and Sleeper stretch on Shoulder pain, Disability, Shoulder range of motion and Scapulohumeral rhythm.
Study design: It is a randomized control trial study.
Place and duration of study: A Six-month study was carried out in The Physiotherapy Clinic, Saidpur Road, Rawalpindi.
Material and Methods: 44 patients who had stage 1 and 2 Adhesive capsulitis with idiopathic onset of symptoms were randomly allocated through sealed enveloped method in Group A (Sleeper stretch) and B (mobilization with movement) i.e. 22 patients in each group. The frequency of treatment was 3 sessions per week for a total of 4 weeks. Tools used in the study were Numeric pain rating scale (NPRS), Shoulder pain and disability index (SPADI), Goniometer and Inclinometer.
Results: Between group Analysis showed significant difference in effects of MWM and Sleeper stretch in decreasing pain, improving shoulder disability, shoulder ranges of motion i.e. (adduction, abduction, extension and external rotation) with p value <0.001. Within group Analysis showed that shoulder pain, shoulder disability and some shoulder ranges were significantly improved by MWM, whereas shoulder flexion and internal rotation were improved more in sleeper stretch group. Scapulohumeral rhythm showed no significant improvement with p value > 0.05 in both groups.
Conclusion: The results conclude that Mobilization with movement is productive in improving pain, disability and shoulder ranges except shoulder flexion and internal rotation which improved more in Sleeper stretch. Whereas both interventions had no significant effects on Scapulohumeral rhythm

Keywords: Adhesive capsulitis, NPRS, SPADI, Scapulohumeral rhythm, Sleeper stretch, mobilization with movement.

1. Introduction

Adhesive capsulitis, also recognized as arthrofibrosis, is a dysfunctional disorder in which a person's own body create excessive scar tissue and adhesions around the shoulder joint, causing excessive pain, stiffness, as well as functional limitations.[1] The majority of the time, shoulder pain is initially noticed on night or when the shoulder moved approximately to the limits of range of motion (ROM). Certain synchronized shoulder movements, such as external rotation and abduction (for example, when combing one's hair) or internal rotation and extension (e.g., scratching ones back) can cause shoulder pain.[2] Contracture being the other key characteristic causes progressive decline of active range of motion i.e. AROM and passive range of motion i.e. PROM in a capsular pattern at glenohumeral joint.[3]

It is a type of condition that resolves on its own without any treatment within 12 to 36 months but symptoms may persist for up to 10 years in 20-50% of the population.[4] According to estimates, between 2 and 5% of the general population suffers from adhesive capsulitis, with females being more frequently affected than males.[5]

Population ranging between 40-60 years is most likely to get diagnosed with a frozen shoulder.[6] The chief symptom of adhesive capsulitis is shoulder joint discomfort that is supplemented by a noticeably reduced ROM. A dull, poorly localized uneasiness that may radiate into the biceps is the pattern of pain amongst people. Reaching over head or behind the back may cause discomfort and stiffness.[7]

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Numerous therapies, including oral medicines, corticosteroid injections, distension, manipulation, and surgery, and Manual therapy have been studied as ways to treat pain and capsular contractions. Different studies demonstrate the efficacy of manual therapy techniques for the treatment of adhesive capsulitis, including high and low-grade glenohumeral mobilizations,[22] proprioceptive neuromuscular facilitation,[23] muscle energy techniques,[24] scapular mobilization,[25] manual muscle release, mobilization with movement,[26] and sleeper stretch.[8]

The objective of this study was to determine the effects of Sleeper stretch and Mobilization with movement on Pain, Shoulder range of motions, Functional disability and Scapulohumeral rhythm in patients with Adhesive capsulitis.

Various studies[10] have been conducted to check the effects of mobilization with movement and sleeper stretch for improving shoulder pain and ROM in patients with Adhesive capsulitis individually however there is lack of evidence to allow conclusions to be drawn about the effectiveness of MWM when compared with Sleeper stretch for Adhesive capsulitis. This study will add to the growing body of knowledge that if these two techniques yield comparable outcomes, which should be the alternate choice of therapy. Many researches claims that Scapulohumeral rhythm gets disturbed in Adhesive capsulitis. This study also aims to check whether these techniques are effective in improving Scapulohumeral rhythm and which one is better between both techniques.

2. Materials & Methods

A Randomized controlled trial (RCT) was conducted at the Physiotherapy clinic, satellite town Rawalpindi. After the approval from Riphah international university ethics review committee, BASR and permission from The Physiotherapy Clinic. Ethical values during study were considered on priority. The sample size was calculated using the G power with post treatment values of SPADI. Sample size came out to be 44. (9) Non probability purposive sampling was used and patients were randomly allocated using sealed envelope method in group A and B, 22 participants in each group .

Only those patients were included in the study who had stage 1 and 2 Adhesive capsulitis[10], age ranging between 40-65 years,[11] idiopathic onset of disease,[12] patients having unilateral symptomatic shoulder without any traumatic history,[13] marked decrease in active and passive ranges specifically shoulder Abduction, Internal rotation, external rotations[14] and patients having 1.5cm asymmetry on affected side through bilateral comparison during lateral scapular slide test.[15] Both male and female patients were included in the study. Patients having any neurological abnormalities,[16] rotator cuff injuries,[17] recent traumatic history,[18] bone disorders, cervical radiculopathy, cardiovascular impairments,[19] malignancy and those who received any intra articular injections in the shoulder joint during last three months were excluded from the study.[20]

All patients were provided with complete information about the study and intervention and written informed consent was signed before the treatment program in English/Urdu according to the need. The patients were reassured that there was no potential harm of the intervention and they have the right to withdraw from the study anytime they want. Patients were randomly allocated in Group A receiving Sleeper stretch and Group B receiving Mobilization with movement. Conventional therapy which included Hot pack for 15 minutes, Interferential therapy for 15 minutes, Active Range of motion exercises such as wall ladder exercise, towel stretch ex, Codman exercise, Wand exercise, Rope and pulley exercise, shoulder wheel exercise[22] were given to both groups Demographic data was collected using self-structured questionnaire. Patients were assessed on baseline, end of 2nd week and end of 4th week. Questionnaire comprised of demographics, Numeric Pain Rating scale with ICC= 0.74 for shoulder pain, and Shoulder pain and disability index questionnaire with ICC for pain scale 0.989, and ICC for disability 0.990 in Adhesive capsulitis, Shoulder range of motion using goniometer with ICC variying from 0.91 to 0.99, and Scapulohumeral rhythm measurement using inclinometer, with ICC > 0.892.

Data was analyzed with SPSS version 25. Normality of data was checked through Shapiro-wilk and p value of most of variables were < 0.05 as shown in table Demographics and descriptive data was presented in form of percentages, frequencies and mean + SD. Mixed way ANOVA was used for between group analysis whereas within group analysis was carried out through Repeated measure Anova.

3. Results

Out of 22 participants in each group there were 13(29.5%) males and 9(20.5%) females in Group A and

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7(15.9%) males and 15(34.1%) females in Group B. Mean age of Group A and Group B was 54.13 + 6.33 and 49.22 + 6.67 years respectively. The occupation details of the participants in Group A were as follow 9(40.9%) house wife, 5(22.7%) computer operators, 1(4.5%) construction workers, 2(9.1%) business men, 4(18.2%) drivers, 1(4.5%) labors, and in Group B 10(45.5%) house wife, 9(40.9%) computer operators, 0 construction workers,1 (4.5%) business men, 2(9.1%) drivers, 0 labors.

A two way mixed ANOVA was carried out in order to investigate the impact of intervention and time on NPRS. There was not a significant main effect of intervention F-value = .002 and p-value = .962. However, there was a significant main effect of time F =658.621 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 3.68± 1.211 and 2.86± 1.125 respectively, as compared to baseline mean ± SD 6.771± 1.343 and 7.73± .985 respectively. Additionally, there was a significant interaction between intervention and time F= 33.03 and p-value = ≤ 0.001.

On shoulder pain and disability index a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .255 and p-value = .616. However, there was a significant main effect of time F = 593.75 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 31.77± 9.61 and 20.18± 4.61 respectively, as compared to baseline mean ± SD 67.51± 11.78 and 81.89± 8.88 respectively. Additionally, there was a significant interaction between intervention and time F= 42.24 and p-value = ≤ 0.001.

a two-way mixed ANOVA was conducted to investigate the impact of intervention and time on Shoulder Flexion ROM. There was a significant main effect of intervention F-value =27.638 and p-value= <.001.Additionally, there was a significant main effect of time F = 610.57 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 146.81±12.96 and 134.77± 9.44 respectively, as compared to baseline mean ± SD 90.45± 17.72 and 72.5± 9.09. However, there was not a significant interaction between intervention and time F= .106 and p-value = .013.

On Shoulder Extension ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value= 21.51 and p-value = <.001. There was a significant main effect of time F = 245.67 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 50.22± 4.49 and 49.31± 4.44 respectively, as compared to baseline mean ± SD 40.68± 6.60 and 30.90± 3.66. Additionally, there was a significant interaction between intervention and time F= 26.02 and p-value = <.001

On Shoulder Abduction ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value = 11.23 and p-value = .002. There was a significant main effect of time F =598.005 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 133.63± 8.61 and 134.09± 11.30 respectively, as compared to baseline mean ± SD 80.90± 18.49 and 67.50± 6.31. Additionally, there was a significant interaction between intervention and time F= .269 and p-value = <.001.

On Shoulder Adduction ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value = 23.14 and p-value = <.001.There was a significant main effect of time F = 257.79 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 47.27± 3.69 and 41.13± 4.34 respectively, as compared to baseline mean ± SD 40.22± 4.49 and 28.86± 5.75. Additionally, there was a significant interaction between intervention and time F= 19.25 and p-value = <.001.

On Shoulder Internal Rotation ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value =59.74 and p-value = <.001. There was a significant main effect of time F = 494.92 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 63.86± 8.98 and 46.36±5.81 respectively, as compared to baseline mean ± SD 24.31± 10.26 and 12.95± 3.33. Additionally, there was not a significant interaction between intervention and time F= .080 and p-value = .040.

On Shoulder External Rotation ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value = 29.02 and p-value = <.001. There was a significant main effect of time F = 356.89 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 46.13± 7.05 and 45.00± 6.725 respectively, as compared to baseline mean ± SD 27.50± 7.02 and 14.54± 4.33. Additionally, there was a

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significant interaction between intervention and time F=23.08 and p-value = <.001.

On Scapulohumeral rhythm 0-45 degree, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .035 and p-value = <.001. However, there was a significant main effect of time F = 499.13 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD .708± .299 and .711± .307 respectively, as compared to baseline mean ± SD -.450± .041 and -.445± .046. Additionally, there was not a significant interaction between intervention and time F= .011 and p-value = .951.

On Scapulohumeral rhythm 0-90 degree, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .163 and p-value = .689. However, there was a significant main effect of time F = 100.54 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD .087± .038 and .080± .0377 respectively, as compared to baseline mean ± SD -.305± .1105 and -.304± .119. Additionally, there was not a significant interaction between intervention and time F= .270 and p-value = .699

On Scapulohumeral rhythm 0-120 degree, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .022 and p-value = .884. However, there was a significant main effect of time F = 199.72 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD .1371± .0807 and .1304± .0787 respectively, as compared to baseline mean ± SD -.278± .1294 and -.2780± .1374. Additionally, there was not a significant interaction between intervention and time F= .092 and p-value = .851

Figure 1: Comparison of NPRS values in Group A and B with time

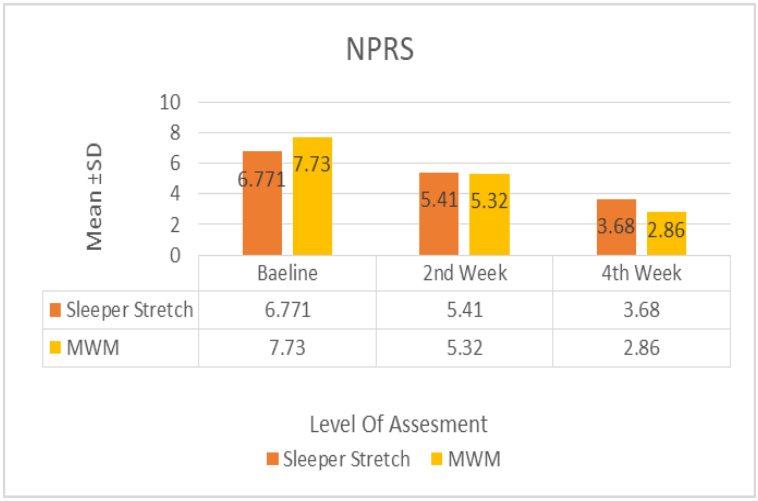
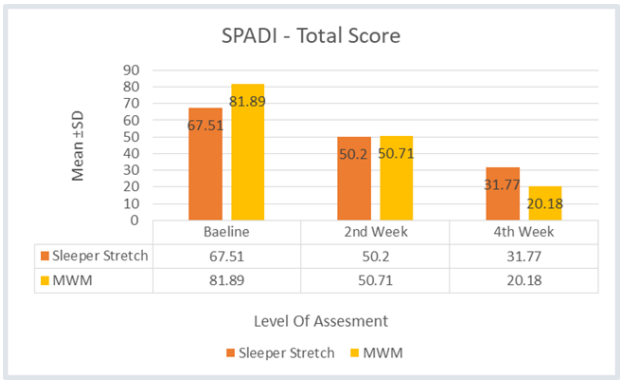


Figure 2: Comparison of SPADI value in Group A and B with time



4. Discussion

Within group Analysis of Numeric pain rating scale for shoulder pain showed that both techniques i.e. sleeper stretch and mobilization with movement are effective in reducing shoulder pain for patients having adhesive capsulitis with P value ≤ 0.001 but MWM is more effective in reducing pain as compared to sleeper stretch. For SPADI both techniques i.e. sleeper stretch and mobilization with movement are effective in reducing shoulder disability for patients having adhesive capsulitis with P value ≤ 0.001 but MWM is more efficient in reducing pain as compared to sleeper stretch. For shoulder ranges i.e. Flexion, Extension, Abduction, Adduction, Internal Rotation, and External Rotation both techniques i.e. sleeper stretch and mobilization with movement is effective in improving shoulder ranges for patients having adhesive capsulitis with P value ≤ 0.001. MWM is more efficient in improving shoulder ranges (Extension, abduction, Adduction and External rotation)

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Flexion was improved more in the group receiving sleeper stretch. For Scapulohumeral rhythm at 45 degree, 90 degree and 120 degree both techniques i.e. sleeper stretch and mobilization with movement are effective in improving Scapulohumeral rhythm for patients having adhesive capsulitis with P value ≤ 0.001.

Conclusion:

This research article concludes that there is a significant difference in effects of Sleeper stretch and mobilization with movement, MWM being more beneficial than the other technique in decreasing pain, reducing shoulder disability and improving shoulder range of motions except flexion and internal rotation range of motion. Nevertheless in case of Scapulohumeral rhythm it was observed that there was no advent difference in effects of both techniques i.e. sleeper stretch and mobilization with movement. The limitation faced during this study is that it was difficult to measure Scapulohumeral rhythm at 45, 90 and 120 degree with bubble inclinometer for future researches it is recommended to use digital inclinometer. Other limitations faced during the study is that the gender was not equally distributed between both groups and retention of intervention was not measured in long term follow up plan. For future scope control group can be added in the study as well to make it more efficient.

References:

1. Le HV, Lee SJ, Nazarian A, Rodriguez EKJS, elbow. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. 2017;9(2):75-84.
2. Staples MP, Forbes A, Green S, Buchbinder RJJoce. Shoulder-specific disability measures showed acceptable construct validity and responsiveness. 2010;63(2):163-70.
3. Deshmukh N, Kahile M, Chaudhary N, Panchbhudhe S, Gawande VJIJoCR, Review. Adjunct effect of kinesiotaping on adhesive capsulities of shoulder joint. 2021;13(08):48-53.
4. Fields BK, Skalski MR, Patel DB, White EA, Tomasian A, Gross JS, et al. Adhesive capsulitis: review of imaging findings, pathophysiology, clinical presentation, and treatment options. 2019;48:1171-84.
5. Sunderamuthy K, Govind S, Wah YC, Singh KJA. Maitland Vs Kaltenborn Approach in Improving Pain and External Rotation in Adhesive Capsulitis. 2019;50(55):56-60.
6. Ramirez JJAfp. Adhesive capsulitis: diagnosis and management. 2019;99(5):297-300.
7. Cho C-H, Bae K-C, Kim D-HJCios. Treatment strategy for frozen shoulder. 2019;11(3):249-57.
8. Ishaq H, Zuber M, Kandakurti PK, Arulsingh WJCRiP, Medicine R. Do Manual Therapy Techniques Help in Patients with Frozen Shoulder?: A Systematic Literature Review. 2022;34(2).
9. Kotagiri S, Mathur N, Balakavi G, Songa AK. The Effectiveness of Muscle Energy Technique and Mobilization to Improve the Shoulder Range of Motion in Frozen Shoulder. 2019.
10. Chidambaram R, Muruganandam P, Bhandure KSJIJoP, Print-OT, Electronic–. The Efficacy of Sleeper's Stretch and Movement with mobilization on Pain, Range of Motion & Functional Capacity in Patients with Adhesive Capsulitis. 2020;14(4):149-55.
11. Mishra N, Mishra A, Goti KJIJRSR. Effect of capsular stretch versus sleeper stretch on pain, rom and shoulder functions in patients with adhesive capsulities-a comparative study. 2018;9(4):25634-7.
12. Nithya N, Prabu SS, Arun B, Abraham MMJIJoPHR, Development. Effect of Mulligan's Mobilization with Movement and Post Isometric Relaxation Technique on Pain, Range of Motion and Functional Outcome in Subjects with Adhesive Capsulitis. 2021;12(3):185-91.
13. Kundu S, Sherke A, Ughade JM, Kanwar Y, Jatwar R, Tiwari S, et al. Scapulohumeral RYTHM: Anatomical Highlights and Clinical Implications.
14. Tedla JS, Sangadala DRJJom, interactions n. Proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: a systematic review and meta-analysis. 2019;19(4):482.
15. Pitchai P, Krishnan V, Mangle KJJoC, Medicine I. Functional status in adhesive capsulitis–yoga vs. physiotherapy: a quasi experimental study. 2020;18(2):363-9.
16. WADIDA HE, EL SAWABEY MFS, DALIA MM, ASHRAF NMJTMJoCU. Effect of Mobilization with Movement versus Diclofenac Phonophoresis on Shoulder Adhesive Capsulitis. 2020;88(March):45-50.
17. Ragav S, Singh AJJoES, Vol P. Comparison of effectiveness of mulligan 'MWM'technique versus kaltenborn mobilization technique on pain and end range of motion in patients with adhesive capsulitis of shoulder joint: A randomized controlled trial. 2019;15(1).
18. WADIDA HE, EL SAWABEY MFS, DALIA MM, ASHRAF NMJTMJoCU. Effect of Mobilization with Movement versus Diclofenac Phonophoresis on Shoulder Adhesive Capsulitis. 2020;88(March):45-50.

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19. Sunderamuthy K, Govind S, Wah YC, Singh KJA. Maitland Vs Kaltenborn Approach in Improving Pain and External Rotation in Adhesive Capsulitis. 2019;50(55):56-60.

20. Sivasubramanian H, Chua CXK, Lim SY, Manohara R, Ng ZWD, Kumar P, et al. Arthroscopic capsular release to treat idiopathic frozen shoulder: How much release is needed? 2021;107(1):102766.

21. Nawaz S, Anwar S, Humayun K, Nawaz S, Kazmi SK, Ilyas U, et al. Comparative Study on the Effects of Mulligan Mobilization Technique and Muscle Energy Technique on Pain and Range of Motion in Adhesive Capsulitis.1(11):82.18-0.68.

22. Silva R, Pimentel A, Gutierres M. A literature review of the treatment options for Idiopathic Adhesive Capsulitis of the Shoulde. Orthopedics and Sports Medicine Open Access Journal. 2021; 9:460-468.

23. Maund E, Craig D, Suekarran S, Neilson A, Wright K, et al. (2012) Management of frozen shoulder: a systematic review and cost-effectiveness analysis. Health Techno Assess 16(11): 1-264.

24. Shanker Tedla J, Sangadala D. Proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: a systematic review and meta-analysis. Journal of Musculoskeletal and Neuronal Interactions. 2019; 19(4):482-491.

25. Kumar A. A comparative study on the efficacy of Maitland's mobilization and muscle energy technique on frozen shoulder. Indian J Physiotherapy Occupation Therapy. 2015; 9: 39–43. doi:10.5958/0973-5674.2015.00143.4

26. Kiran Satpute, Sue Reid, Thomas Mitchell, Grant Mackay & Toby Hall (2022) Efficacy of mobilization with movement (MWM) for shoulder conditions: a systematic review and meta-analysis, Journal of Manual & Manipulative Therapy, 30:1, 13-32, DOI: 10.1080/10669817.2021.195518

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Table 1: Mixed way ANOVA time, treatment group and interaction effect of NPRS and SPADI

Sr. No	Variables		Group A	Group B	Time			Treatment Group			Interaction effect		
			Mean ± SD	Mean ± SD	F-value	η2	p-value	F-value	η2	p-value	F-value	η2	p-value
1.	NPRS	Baseline	**6.771± 1.343**	**7.73± .985**	**658.621(1.748)**	**.940**	**≤ 0.001.**	**.002(1)**	**.000**	**.962**	**33.03 (1.748)**	**.440**	**≤ 0.001.**
		2nd Week	**5.41± 1.008**	**5.32± 1.129**									
		4th Week	**3.68± 1.211**	**2.86± 1.125**									
2.	SPADI	Baseline	**67.51± 11.78**	**81.89± 8.88**	**593.75(1.400)**	**.934**	**≤ 0.001.**	**.255(1)**	**.006**	**.616**	**42.24 (1.400)**	**.501**	**≤ 0.001.**
		2nd Week	**50.20± 10.43**	**50.71± 6.98**									
		4th Week	**31.77± 9.61**	**20.18± 4.61**									

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Table 2: Mixed way ANOVA time, treatment group and Interaction effect of Shoulder ranges and Scapulohumeral rhythm

Sr. No	Variables		Group A	Group B	Time			Treatment Group			Interaction effect		
			Mean ± SD	Mean ± SD	F-value	η2	p-value	F-value	η2	p-value	F-value	η2	p-value
3.	Shoulder Flexion ROM	Baseline	**90.45± 17.72**	**72.5± 9.09**	**610.571(1.730)**	**.936**	**≤ 0.001**	**27.638(1)**	**.397**	**<.001**	**4.968(1.730)**	**.106**	**.013**
		2nd Week	**122.27 ± 14.85**	**99.54± 10.79**									
		4th Week	**146.81 ±12.96**	**134.77 ± 9.44**									
4.	Shoulder Extension ROM	Baseline	**40.68± 6.60**	**30.90± 3.66**	**246.67(1.917)**	**.855**	**≤ 0.001**	**21.51 (1)**	**.336**	**<.001**	**26.02(2)**	**.383**	**≤ 0.001**
		2nd Week	**46.36± 4.41**	**39.31± 5.18**									
		4th Week	**50.22± 4.49**	**49.31± 4.44**									
5.	Shoulder Abduction ROM	Baseline	**80.90± 18.49**	**67.50± 6.31**	**598.005(1.593)**	**.934**	**≤ 0.001**	**11.23 (1)**	**.211**	**.002**	**15.44(1.593)**	**.269**	**≤ 0.001**
		2ND Week	**112.50 ± 12.32**	**94.54± 12.23**									
		4TH Week	**133.63 ± 8.61**	**134.09 ± 11.30**									
6.	Shoulder Adduction ROM	Baseline	**40.22± 4.49**	**28.86± 5.75**	**257.79(2.00)**	**.860**	**≤ 0.001**	**43.14 (1)**	**.507**	**<.001**	**19.25(2)**	**.314**	**≤ 0.001**
		2nd Week	**45.00± 4.08**	**35.45± 6.15**									
		4th Week	**47.27± 3.69**	**41.13± 4.34**									
7.	Shoulder IR ROM	Baseline	**24.31± 10.26**	**12.95± 3.33**	**494.92(1.625)**	**.992**	**≤ 0.001**	**59.74 (1)**	**.587**	**<.001**	**3.654(1.625)**	**.080**	**.040**
		2nd Week	**41.36± 11.03**	**25.68± 3.19**									
		4th Week	**63.86± 8.98**	**46.36± 5.81**									
8.	Shoulder ER ROM	Baseline	**27.50± 7.02**	**14.54± 4.33**	**356.89(1.341)**	**.895**	**≤ 0.001**	**29.02 (1)**	**.409**	**<.001**	**23.08(1.341)**	**.355**	**≤ 0.001**
		2nd Week	**36.59± 6.79**	**25.90± 4.53**									
		4th Week	**46.13± 7.05**	**45.00± 6.725**									
9.	Scapulohumeral rhythm at 45 degree angle	Baseline	**-.450± .041**	**-.445± .046**	**499.13(1.24)**	**.922**	**≤ 0.001**	**.035(1)**	**.001**	**.852**	**.011(1.24)**	**.000**	**.951**
		2ND Week	**-.048±.146**	**-.034±.148**									
		4TH Week	**.708± .299**	**.711± .307**									

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Original Article

Prevalence of amblyopia and strabismus in anisometropic patients

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Abstract

Objective: To find out the prevalence of amblyopia and strabismus in anisometropic patients.
Study design: It is a descriptive cross sectional hospital based study.
Place and duration of study: An Eight-month study was carried out in Ophthalmology department of Holy Family Hospital, Rawalpindi . (from Aprill 2022 to December 2022)
Material and Methods: Sixty patients were studied during the research duration and consecutive sampling technique is followed to collect the sample. Detailed history and examination of patients was done starting from Slit lamp examination followed by assessment of visual acuity, refraction and Fundus examination. Orthoptics assessment was done to the patients who were presented with complaint of deviation.
Results: Out of all the anisometropic patients more than two third were amblyopic. As per data 60 were total patients 46 were amblyopic. Total 09 patients were presented with the Strabismus out of which 07 had esotropia and 02 had Exotropia.12 patients were presented with just the asthenopic symptoms that were corrected with the correction as their visual status reached to the 6/6.
Conclusion: Most commonly anisometropia is associated with the amblyopia and then strabismus. It is more common in females and most commonly affected age groups is 16-25 and then 06-15. There is less prevalence of strabismus because mostly patients are orthophoric.
Keywords: Anisometropia, Refractive Error, Amblyopia, Strabismus.

1. Introduction

Anisometropia is characterized as an asymmetry in the refractive status of individual's both eyes.[1] It can appear in any manner; one eye might be emmetropic and other is ametropic or the both eyes might be ametropic of different values. At the point when difference between refractive status of two eyes is 1D, then retinal size will be vary by the 2% and individuals can tolerate around 5% difference in the refractive status of both eyes that is 2.5D, and above from this relies on patients ability.[2]

Causes of anisometropia include uneven growth of both eyes because axial length of eye balls differ in magnitude. There is positive correlation between the degree of anisometropia and the asymmetry between axial length of two eyes.[3] It has been seen that larger anisometropic refractive errors occur when the vision disruption occurs within the period of most rapid eye growth (up to 3 years of age). Other causes include miscalculation of intraocular lens power during cataract Surgery,[4] trauma to the eye, and retinopathy of prematurity. Retinopathy of prematurity (ROP) is associated with a higher prevalence of anisometropia and more severe anisometropia.[5]

Anisometropia can results in the diplopia. Patient with anisometropia will see blurred image with one eye as compared to the other. Patient may also notice smaller image with one eye and larger image with the other. Other symptoms that the patient will see may include eyestrain, poor depth perception, headache, nausea, light sensitivity, tiredness and dizziness.

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Anisometropia has two basic types one is axial anisometropia and other one is refractive anisometropia. Axial anisometropia is due to difference in axial length between two eyes and Refractive anisometropia is the difference between dioptric power of two eyes. On the basis of types of refractive error, Anisometropia is further classified as simple anisometropa, compound anisometropia and mixed anisometropia. Simple anisometropia is the condition in which one eye is emmetropic and other is ammetropic. On the basis of ametropic eye simple anisometropia divided into Simple Myopic Anisometropia or Simple Hypermetropic Anisometropia. Compound Anisometropia in which both eyes are myopic or hypermetropic but of different values, and this is further subdivided into Compound Myopic or Compound Hyperopic Anisometropia. Mixed Anisometropia which is also called antimetropia, is the condition in which one eye is myopic and other is hypermetropic. And when classification made on the presence of astigmatism, anisometropia is further divided into simple astigmaic anisometropia, compound astigmatic anisometropia and mixed astigmatic anisometropia.

Anisometropia can leads to the disruption in Binocular single vision (BSV) if it remains untreated in the lon run. Binocular Single Vision is the ability of both eyes to contributes to the simultaneous perception, so that single image formed on retina. Grades of Binocular Single vision are; Simultaneous perception: in this grade object is perceived at the same time by the both eyes, Fusion: when two retinal images gather to form a single image and Stereopsis: is the peak stage where fused images with slight horizontal disparity gives three dimensional image. Normally BSV is present in patients with low anisometropia but if it remains untreated and increase to higher level, it can affect fusion, produce amblyopia and strabismus.[6] Anisometropia is the leading causative agent in the development of amblyopia and strabismus in childhood.[7] Amblyopia is defined as a unilateral or sometime bilateral decrease in visual acuity after best possible correction even when there is no deformity in eye structure and visual pathway is present. Anisometropia causes amblyopia in a way that, when visual power of eyes varies, size and form of image falling on retina also changes. And when significant error continuously occurs, it causes the blur image on retina, that results into the amblyopia. Prevalence of amblyopia shows that, anisometropic amblyopia is 24-37% of all the amblyopias.[8] Severe anisometropias (3 or more D) are more prone to persist in preschool age.[9] Different studies shows that prevalence of amblyopia is higher in the anisohyperopes as compared anisomyopes.[10] Hyperopic anisometropia of only 1-2 degree can cause amblyopia whereas myopic anisometropia of 3D usually does not cause amblyopia. This might be due to the earlier development of unilateral blur in the presence of hyperopic anisometropia, with a higher impact on the visual cortex maturation than in myopic anisometropia.[11]

Examination of Amblyopic eye shows that it cannot be improved to the 6/6. Pinhole test shows no improvement. There is difference of 2 or more Snellen lines between vision of two eyes. Amblyopia is not a simple phenomenon, with the loss of Snellen acuity there is also loss of contrast sensitivity of stimulus,[12] stimulus shape distortion, uncertainity in position of stimulus and also increase in magnitude of crowding phenomenon.[13]

Strabismus is the misalignment of visual axes of two eyes. Image of one eye projected on retina whereas other form on extra foveal region which results in diplopia. And children that have strabismus avoid this phenomenon by suppressing the image of deviating eye, this results in defective binocular single vision. One of the prior reasons of concomitant strabismus is the high refractive error. Hyperopia and Astigmatism usually associated with the convergent squint, whereas myopia have association with the divergent squint. Both of the conditions amblyopia and strabismus occurs with the anisometropia, but this does not mean every anisometropic patient will present with these conditions. In high anisometropia, One eye that have high refractive error, see blur image than the other eye, as a result this eye starts to suppress its image. This abnormal visual experience disrupts the interocular alignment resulting in strabismus by interfering with the sensory development.

Anisometropia mostly associated with amblyopia. And different studies shows that this anisometropic amblyopia is commonly associated with strabismus.[14] Out of all human population 1-3% have amblyopia and about one half to two thirds of amlyopic persons have anisometropia alone or with the combination of strabismus.[15] From all types of anisometropias,

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hyperopic anisometropia have significant risk for the amblyopia and increasing the severity of strabismus.[16] Different studies shows that hyperopia of 1-2D, if not corrected early in life will cause amblyopia and convergent squint (accomodative esotropia).[17] Due to the high prevalence of hyperopia as compared to the myopia, this is demonstrated that, when strabismus will associated with anisometropia, it will usually convergent and found in anisohyperopes rather than in anisomyopes.[18] Different studies shows that anisometropia have direct relationship with the amblyopia and strabismus, so as anisometropia increases, amblyopia and degree of concomitant strabismus increases as well.[19] When we compare the association of the amblyopia and strabismus with the anisometropic patients, amblyopia and anisometropia are most frequently associated. Various studies show that Anisometropic amblyopia is almost twice as frequent as the strabismic amblyopia.

Treatment of Ansometropia and its association, involves correcting the refractive error by wearing glasses, treating the lazy eye (amblyopia) and squint surgery to correct the appearance of squinted eye and vision problem by restoring the binocular vision. First step should always be the correction of refractive error. Because if refractive error would be the cause of amblyopia and strabismus, then full refractive correction will give beneficial results to the patients. For example in most of cases if hypermetropia causing squint, glasses usually correct it. In case of high anisometropia, if patient wear spectacles, these can cause aniseikonia and BSV will be disturbed. Also patients will experience asthenopic symptoms such as strain and headache. However we can make aniseikonic spectacle to compensate this situation. Contact lenses are also the option for such patients, because these lenses not minify or magnify images too much, that's why these are the better options.

Then treat amblyopia by patching good eye. The main objective of patching is to restrict the use of good eye, in order to force the lazy eye to work. If this is done in early childhood, the vision will improve, often to the normal level. The length of treatment with an eye patch varies with the age of the child and the severity of the amblyopia.[21] The patch may be worn for a few hours a week or for most of the day. Treatment is continued until either the vision is normal or until no further improvement is found. Child should be followed up to make sure that treated eye is still being improved or become amblyopic again. One of the problems with patching vision for amblyopia is that children either don't want to wear the patch, or don't wear it enough for it to be effective. For this purpose, vision therapy included playing games with the child is encouraged so that affected eye work more. To help this condition various special spectacles are also made that encourage children to use the lazy eye. For example, LCD shutter glasses which give a blurred image to the strong eye and clear image to the weak eye and then children are asked to watch a 3D movie wearing the glasses for one hour per day. It helps the patient to enhance brain-eye coordination and increases muscles control to improve focus. By using this type of methodologies children can be tackled and their vision can be improved. Surgical options advised to the patients to improve the appearance of eyes by straighten them. It can also restore binocularity. It involves tightening, loosening or moving one or more of the eye muscles. This is the procedure that requires expertise, time and knowledge.

2. Materials & Methods

Descriptive cross-sectional hospital based study of 09 months duration was conducted from 01st of Aprill 2022 to the 20th of December 2022. Out of 24,618 patients from eye OPD of Holy Family Hospital Rawalpindi 9269 were referred to refraction room. Considering time availability sample size was 60 patients of anisometropia who were symptomatic and consecutive sampling technique is followed to collect the sample.The data of anisometropic patients who were exposed to diagnostic criteria was obtained on specially designed proformas. Detailed history and examination of patients was done starting from Slit lamp examination followed by assessment of visual acuity, refraction and Fundus examination. Orthoptics assessment was done to the patients who were presented with complaint of deviation. Patients of both gender which include chidren, teenagers and adults were included, especially the patients who presented with the decreased vision in one eye, deviation in eyes and asthenopic symptoms were studied. And the patients who excluded from the study were those who were non cooperative and did not willing to be part of research study. And also those who presented with the significant pathology such as DR, keratitis, cataract, corneal dystrophy etc.

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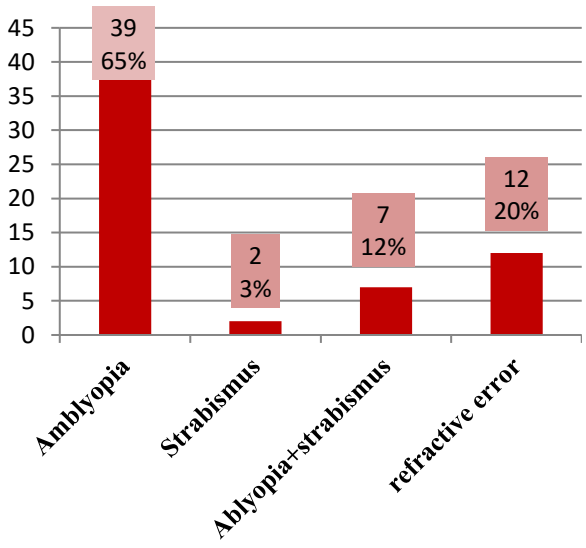
3. Results

Result of my study in fig:I gave the comparative association of all the consequences in anisometropic patients. I found that most commonly, anisometropia results in the Amblyopia as 39 out of 60 anisometropic patients were amblyopic that is 65% of total symptomatic anisometropia cases. There were 2 (3%) out of 60 with strabismus, 7 (12%) out of 60 had both amblyopia and strabismus and 12 (20%) out of 60 had only decreased vision complaint that reached to normal visual acuity status (6/6) by appropriate optical correction.

Fig I: Prevalence of amblyopia and strabismus in anisometropic patients



Age based distribution showed that anisometropia was most common in age group of 16-25 out of 4 groups and then in age group between 5-15. 16-25 age group contain 25 patients whereas 5-15 age group had 22 patients. This showed that anisometropia was usually common in young people and children. Frequency and percentage of anisometropic patients in different age groups was 5-15 (22, 37%) ,16-25 (25, 42%), 26-35 (8, 13%) , 36-45 (5, 8%). Gender based distribution showed that Anisometropia was more prevalent in the females as compare to males. Percentage of females was 53% and of males was 47%. Results of my research study in table:I showed that 7 (12%) out of 60 had Esotropia, 2 (3%) out of 60 patients had exotropia and 51 (85%) out of 60 patients were orthophoric. Prevalence of amblyopia in anisometropic patients was also described which showed that 46 (77%) out of 60 patients were amblyopic and 14 (23%) out of 60 were without amblyopia.

Table I: Prevalence of amblyopia in Anisometropic patients

Amblyopia	Frequency	Percent
Present	46	77%
Absent	14	23%
Total	60	100%

4. Discussion

Anisometropia is a binocular condition with different refractive power in both eyes. It is a serious condition because if neglected, it may lead to amblyopia or deviation in the eye. Amblyopia is defined as a Unilateral or in some cases, bilateral decrease in visual acuity after best possible correction. It is not related to any deformity in eye structure or visual pathway. One of the principle reason of amblyopia is anisometropia. Because when visual power of both eyes varies from each other, size and form of image falling on the retina also varies. If a significant refractive error constantly causes the blurr image on the retina of the eye, it can result into the amblyopia. Anisometropia can also results into the strabismus that is simply the misalignment of eyes. Asthenopic symptoms associated with the anisometropia includes deviation of eyes, double vision and eye strain. Different researches show that asthenopic symptoms associated with the untreated refractive errors. So the patients who have untreated anisometropia develops asthenopic symptoms. The purpose of this study is to prove with discussion and results that which one of these consequences is commonest.

The study was started on 01st of April 2022 till 20th of December 2022. Out of 24,618 patients from Holy Family Hospital, Rawalpindi, 9269 were referred to refraction room. Considering time availability sample size was 60 patients of anisometroopia who were symptomatic. Result of this study showed the comparative association of all the consequences in anisometropic patients. It showed that most commonly anisometropia result in the Amblyopia as 39 out of 60

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anisometropic patients were amblyopic that is 65% of total symptomatic anisometropia cases. There were 2 (3%) out of 60 with strabismus, 7 (12%) out of 60 had both amblyopia and strabismus and 12 (20%) out of 60 had only decreased vision complaint that reached to normal visual acuity status (6/6) by appropriate optical correction. These results support the study of YH Aldebasi which also showed that anisometropic amblyopia is more prevalent as compared to the strabismus. My research study showed that anisometropia was most common in age group of 16-25 out of 4 groups and then in age group between 5-15. 16-25 age group contained 25 patients whereas 5-15 age group had 22 patients. This showed that anisometropia was usually common in young people and children. Frequency and percentage of anisometropic patients in different age groups was 5-15 (22, 37%), 16-25 (25, 42%), 26-35 (8, 13%), 36-45 (5, 8%). Gender based distribution of anisometropia showed that it was more prevalent in the females as compare to males. Percentage of females was 53% and males was 47%. And when patients were distributed on the criteria of presence of strabismus, I came out with the results that 7 (12%) out of 60 had Esotropia, 2 (3%) out of 60 patients had exotropia and 51 (85%) out of 60 patients were orthophoric. Further category was made to check prevalence of amblyopia in anisometropic patients, results described that 46 (77%) out of 60 patients were amblyopic and 14 (23%) out of 60 were without amblyopia. This condition showed that more than two third patients had amblyopia which support the results of J South,T Gao,A Collin, J Turuwhenua. According to their study out of all the Anisometropic patient that they took during their research about 2/3rd patients had amblyopia. In the end from the whole research I found that amblyopia was more prevalent than the strabismus, because I found that only 9 patients out of 60 were presented with the strabismus whereas 39 patients were of amblyopia.

Limitations of my study was the small sample size and just one hospital for research study. Larger sample size with more than one hospital could give the better results.

Conclusion:

Most commonly anisometropia is associated with the amblyopia and then strabismus. It is more common in females and most commonly affected age groups is 16-25 and then 06-15. There is less prevalence of strabismus because mostly patients are orthophoric.

References:

1. Brooks SE, Johnson D, Fischer N. Anisometropia and binocularity. Ophthalmology. 1996 Jul 1;103(7):1139-43.

2. Chowdhury PH, Shah BH. Precise information on anisometropia. Biomedical Journal. 2018;1:2.

3. Huynh SC, Wang XY, Ip J, Robaei D, Kifley A, Rose KA, Mitchell P. Prevalence and associations of anisometropia and aniso-astigmatism in a population based sample of 6 year old children. Br J Ophthalmol. 2006 May;90(5):597-601.

4. Hashemi H, Khabazkhoob M, Yekta A, Mohammad K, Fotouhi A. Prevalence and risk factors for anisometropia in the Tehran eye study, Iran. Ophthalmic epidemiology. 2011 Jun 1;18(3):122-8.

5. Quinn GE, Dobson V, Repka MX, Reynolds J, Kivlin J, Davis B, Buckley E, Flynn JT, Palmer EA. Development of myopia in infants with birth weights less than 1251 grams. The Cryotherapy for Retinopathy of Prematurity Cooperative Group. Ophthalmology. 1992 Mar;99(3):329-40.

6. Morya AK, Solanki K, Bhandari S, Naidu A. Binocular Functions. InEye Motility 2019 Mar 12.

7. Dadeya S, Shibal F. The effect of anisometropia on binocular visual function. Indian journal of ophthalmology. 2001 Dec 1;49(4):261.field in patients with suppression. Japanese journal of ophthalmology. 2009 Mar;53(2):138-4420

8.Chang CH, Tsai RK, Sheu MM. Screening amblyopia of preschool children with uncorrected vision and stereopsis tests in Eastern Taiwan. Eye (Lond). 2007 Dec;21(12):1482-8.

9. Pai AS, Rose KA, Leone JF, Sharbini S, Burlutsky G, Varma R, Wong TY, Mitchell P. Amblyopia prevalence and risk factors in Australian preschool children. Ophthalmology. 2012 Jan;119(1):138-44

10. . Bharadwaj SR, Candy TR. The effect of lens-induced anisometropia on accommodation and vergence during human visual development. Invest Ophthalmol Vis Sci. 2011 Jun 01;52(6):3595-603.

11. Abrahamsson M, Sjöstrand J. Natural history of infantile anisometropia. Br J Ophthalmol. 1996Oct;80(10):860-3.

12. Bradley AFreeman RD Contrast sensitivity in anisometropic amblyopia. Invest Ophthalmol. 1981;21467- 476

13. Stuart JABurian HM A study of separation difficulty. Am J Ophthalmol. 1962;53471- 477

14. Duman R, Atilla H. Farklı ambliyopi tiplerinde klinik seyir ve tedavi. Turk J Ophthalmol. 2013;43:326–334.

(C) 2023 by Rawalpindi Medical University

15. Barrett BT, Bradley A, Candy TR. The relationship between anisometropia and amblyopia. Progress in retinal and eye research. 2013 Sep 1;36:120-58

16.Smith III EL, Hung LF, Arumugam B, Wensveen JM, Chino YM, Harwerth RS. Observations on the relationship between anisometropia, amblyopsia and strabismus. Vision research. 2017 May 1;134:26-42

17. .Lepard CW. Comparative changes in the error of refraction between fixing and amblyopic eyes during growth and development. Am J Ophthalmol. 1975 Sep;80(3 Pt 2):485-90.

18. Otsuka J, Sato Y. [Comparison of refraction in orthophoric hyperopic eyes and accommodative esotropic eyes]. Nippon Ganka Gakkai Zasshi. 1984 Jan;88(1):58-64

19. Duman R, Atilla H, Çatak E. Characteristics of Anisometropic Patients with and without Strabismus. Turk J Ophthalmol. 2018 Feb;48(1):23-26. doi: 10.4274/tjo.44342. Epub 2018 Feb 23. PMID: 29576894; PMCID: PMC5854855.

20. Kivlin JD, Flynn JT. Therapy of anisometropic amblyopia. J Pediatr Ophthalmol Strabismus. 1981 Sep-Oct;18(5):47-56.

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Original Article

Effectiveness of Kinesiology Taping In Acute Medial Tibial Stress Syndrome

Rabbiya Riaz[1], Anam Javed[2], Shifa Saleem[3], Irum shaheen[4], Sammar Abbas[5], Rabbyya kausar[6]

Abstract

Objective: to evaluate the effectiveness of Kinesiology Taping with conventional physical therapy in patients with Medial Tibial Stress Syndrome.

Study design: It is a randomized control trial study.

Place and duration of study: A five-month study was carried out in Smart Health and fitness club (SMARTS) and Fitdiction Gym Islamabad. (from April 2019 to August 2019)

Material and Methods: Athletes with ages between 18-35 years, of both gender, having MTSS score between 4-10 were recruited in the study. A total of 30 patients were split into two groups randomly, with 15 in each. Group 1 received Kinesiology Taping alongside conventional physical therapy (Cryotherapy+ TENS+ Calf muscle stretch), while Group 2 only received conventional physical therapy. Treatments were administered every other day for three weeks**.**

Results: Within the group analysis utilized repetitive measure ANOVA. The average NPRS percentages for both groups were similar at the start. However, for the experimental group NPRS percentages as well as average MTSS percentage, there was a significant decrease till the end (0.90 &1.00 respectively) of the sessions. Between-group analysis was carried out using an independent t-test. Both the NPRS and MTSS results were statistically significant in both groups ($p<0.01$), but the mean values indicated that the experimental group exhibited a greater reduction in pain and an enhanced functional level compared to the control group**.**

Conclusion: Kinesiology taping combined with standard physical therapy proved effective in lessening pain and enhancing the functional status of athletes with medial tibial stress syndrome.

Keywords: Medial Tibial Stress Syndrome, Kinesiology Taping, Transcutaneous Electrical Nerve Stimulation, Cryotherapy, Calf Stretch, Numeric Pain Rating Scale, Medial Tibial Stress Syndrome Score.

1. Introduction

Medial tibial stress syndrome (MTSS), also known as shin splints, is a common injury in the lower limb and a major cause of exercise-related leg pain in athletes[1] and runners.[2,3] MTSS is manifested as dull burning or aching pain in the lower leg and leg discomfort caused by repetitive movements on firm surfaces.[4] It is often observed in military recruits due to their very strenuous activities and prolonged standing or marching. Epidemiologically, athletes widely suffer such injuries and the percentage of affected athletes by MTSS is about 4 to 35 percent,[5] 35% in military recruits and 13.6 to 20% specifically in runners.[4] Generally, prevailing percentage persist to be 39% in women and 21% in men.[6] According to the Clement et al the occurrence of MTSS in a female runners (16.8%) is higher than a male runners (10.7%).[7] A number of terms are used to describe this exercise induced pain, including, shin soreness, tibial stress syndrome, shin splint, medial tibial syndrome, shin splints syndrome, exertional leg pain[6] and soleus syndrome.[8,9,10] Repetitive weight bearing activity aggravates its intensity[2,3] and a localized pain and tenderness on palpation[9,20] is usually reported along the middle and the distal thirds of the posteromedial tibia[11] around 5cm of length[6] Resistance tests of the posterior tibial and soleus muscles are painful.[12] Factors that predispose a person towards occurrence of MTSS are female gender[14], preceding history of MTSS, less running experience, orthotic utilize, increased body mass index, increased navicular drop, and amplified external rotation hip range of motion in males[7] as well as pronated foot type[15], bone geometry[10], gait kinematics[11,12], leg length differences[16], lean calf girth , muscle strength and running technique also play their role[17,13].

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Swelling and tenderness along with some other signs are usually observable on tibial posteromedial aspect, during the examination. Radiographs, computed tomography, magnetic resonance imaging, and bone scintigraphy and Shin Palpation Test (SPT), Shin Oedema Test (SOT) can be used to rule out the condition for differential diagnosis.[18,19]

The usual treatment option available during the acute phase is RICE (Rest, Icing, Compression, and Elevation) protocol which is intended to reduce the inflammation and the pain along with use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) for five to seven days.[20] Activity alteration, amendment of modifiable risk factors, custom foot orthosis, shoe modifications, motion control foot wear, therapeutic adhesive taping, splinting or gait training are some of the other available options[1] Alternate treatment in the case of no response to the available options, Injections (cortisones), acupuncture or posterior fasciotomy can also be done.[1] Physical therapy methods and treatments are employed for assistance. Various techniques such as iontophoresis, phonophoresis, ice massage, ultrasound, low-energy laser treatment, periosteal pecking, stretching and strengthening exercises, sports compression stockings, lower leg braces, extracorporeal shockwave therapy, TENS[22,23] and pulsed electromagnetic field have been extensively researched[17,21] along with augmented soft tissue mobilization, whirlpool baths and non-weighted ambulation in the acute stages.[1]

Recently, a technique introduced by Dr. Kenzo Kase in the 70's, which is Kinesiology Taping has attracted interest among sports medicine clinicians for the treatment of many musculoskeletal conditions.[24,25] This technique is expected to have four effects; to adjust muscle function[26] to amplify lymphatic[27] and vascular flow, to lessen pain, to help in the correction of possible articular malalignment[28,29] and it also reduces the irritation and pressure of the neurosensory receptors which produce painful sensations.[30] It also regulates nociceptive processing, stimulate cutaneous mechanoreceptors and change skin tension.

There is dearth of evidence for any of the intervention used for the management of MTSS or any part of Kinesiology Taping for eliminating pain in it is not evident, especially in Pakistan till now. No appropriate treatment decorum for handling MTSS has been recognized so far. Treatment given for MTSS is solitary traditional and no intrusion has much meaning over the other.

So in this study we focused on the use of Kinesiology Taping as an adjunct to traditional physical therapy treatment as the researches have deficiency of data about its effects in MTSS as many authors recommended to further investigate the MTSS Score and we will relate its efficacy with and without KT for decreasing pain and taming quality of health among athletes and runners suffering from acute MTSS. The bringing into play of KT may bequeath us with a more feasible and less protracted approach to reduce recovery time of injury as contrasting to conventional therapeutic modalities and it can benefit athletes as well.

2. Materials & Methods

This randomized control trial was completed over a time period of 05 months from April 2019 to August 2019. Sample size was 30. Data of athletes were selected through non-probability purposive sampling technique and allocated randomly into experimental (n=15) and control groups(n=15) Athletes with ages between 18-35 years, of both gender, having MTSS score between 4-10 were recruited in the study. Asthmatic Patients, Patients with known cardiovascular disease, Open wounds, Uncontrolled hypertension (resting brachial blood pressure ≥ 140/90 mmHg), Any skin allergic condition (Because of KT application) were excluded from the study. Data was collected through self-structured questionnaire for pain at rest via NPRS, pain with activity via NPRS after 50 m sprint activity and MTSS score to assess the severity of Medial Tibial Stress Syndrome. Consent was taken from all the patients included in the study and then interventions were applied. Experimental Group received 10 minutes of cryotherapy followed by 20 minutes of TENS along with passive calf muscles stretching and kinesiology taping afterwards. Control group received cryotherapy for 10 minutes, TENS for 20 minutes along with sustained passive calf muscles stretching for 5 mins. For examining within-group differences, a Repeated Measures ANOVA was employed, and to assess between-group variances, an Independent t-test was used. The data underwent analysis using SPSS version 21.

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3. Results

In a current study, Out of 30 participants males were 11 (36.67%) and females were 19 (63.33%). Figure: 1 showed the participants of different age groups were considered ranging from 18-35 years of age**.**

Results of between groups comparison

Table 1 showed independent t-test interpretation of MTSS (Medial Tibial Stress Syndrome) Score. Baseline score in experimental group(7.40 ± 1.844), whereas baseline score in active control group(7.47 ± 1.552) and the P-value = 0.915. Mid-line score in experimental group (3.40 ± 1.056), whereas mid-line score in active control group(5.40 ± 1.404), with a P-value = 0.000. Final score Mean in experimental group(1.00 ± 1.00), whereas final score in active control group (2.07 ± 1.223),and the P-value = 0.010.

Table 1 Mean, SD & P_ value of baseline, mid line and final MTSS Score between experimental and active control group.

Variables	Group of the participants	Mean±Std. Deviation	*P- value*
Medial Tibial Stress Syndrome's Baseline Score	Experimental	7.40±1.844	0.915
	Active Control	7.47±1.552	
Medial Tibial Stress Syndrome's Midline Score	Experimental	3.40±1.056	0.000
	Active Control	5.40±1.404	
Medial Tibial Stress Syndrome's Final Score	Experimental	1.00±1.000	0.010
	Active Control	2.07±1.223	

The table 2 illustrated independent t-test interpretation of NPRS (Numeric Pain Rating Scale) at Rest. Baseline score at rest in the experimental group (7.87 ± 1.407), whereas baseline score at rest in active control group(7.40 ± 1.595), and the P-value = 0.403. Mid-line score at rest in experimental group(3.33 ± 0.900), whereas mid-line score at rest in active control group (5.07 ± 1.335), and the P-value = 0.000. Final score at rest in experimental group(0.80 ± 1.082), whereas final score at rest in active control group(1.80 ± 1.014), and the P-value = 0.010.

Table 2: Mean, SD & P_ value of baseline, midline and final NPRS at rest between experimental and active control group.

Variables	Group of the Participant	Mean±Std. Deviation	*P _ Value*
Numeric Pain Rating Scale's Baseline Score At Rest	Experimental	7.87±1.407	0.403
	Active Control	7.40±1.595	
Numeric Pain Rating Scale's Midline Score At Rest	Experimental	3.33±.900	0.000
	Active Control	5.07±1.335	
Numeric Pain Rating Scale Final Score AT Rest	Experimental	0.80±1.082	0.010
	Active Control	1.80±1.014	

Table 3 displayed independent t-test interpretation of NPRS (Numeric Pain Rating Scale) with activity. Baseline NPRS score with activity in experimental group(8.93 ± 1.033), whereas baseline NPRS score with activity in active control group(8.60 ± 1.242), and the P-value =0.431. Final NPRS score with activity in experimental group(1.33 ± 1.113),whereas final NPRS score with activity in active control group(2.53 ± 1.125), and the P-value = 0.005.

Table 3: Mean, SD & P_ value of baseline and final NPRS with activity between experimental and active control group.

Variables	Group of the participant	Mean±Std. Deviation	*P _ Value*
Numeric Pain Rating Scale's Baseline Score With Activity	Experimental	8.93±1.033	0.431
	Active Control	8.60±1.242	
Numeric Pain Rating Scale's Final Score With Activity	Experimental	1.33±1.113	0.005
	Active Control	2.53±1.125	

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Results of comparison within groups:

Table 4,5 & 6 showed that Repeated measure ANOVA was applied to do within group comparison, all the P-values obtained were significant and had values less than < 0.05 and the value of Wilk's Lambda was 0.00.

Table 4: within group comparison of MTSS and NPRS at baseline versus Midline.

Variables	Group A (Experimental)			Group B (Active Control)		
	Baseline	Midline		Baseline	Midline	
	Mean±Std.Deviation	Mean±Std. Deviation	P-value	Mean±Std.Deviation	Mean±Std. Deviation	P-value
MTSS	7.40±1.844	3.40±1.056	0.000	7.47±1.552	5.40±1.404	0.022
NPRS	7.87±1.407	3.33±0.900	0.000	7.40±1.500	5.07±1.335	0.035

Table 5: Within group comparison of MTSS and NPRS at Midline versus Final Level.

Variables	Group A (Experimental)			Group B (Active Control)		
	Midline	Final		Midline	Final	
	Mean±Std. Deviation	Mean±Std. Deviation	P-value	Mean±Std. Deviation	Mean±Std. Deviation	P-value
MTSS	3.40±1.056	1.00±1.000	0.002	5.40±1.404	2.07±1.223	0.015
NPRS	3.33±0.900	0.80±1.082	0.000	5.07±1. 1	1.80±1.014	0.005

Table 6: Within group comparison of MTSS and NPRS at baseline versus Final level.

Variables	Group A (Experimental)			Group B (Active Control)		
	Baseline	Final		Baseline	Final	
	Mean±Std. Deviation	Mean±Std. Deviation	P-value	Mean±Std. Deviation	Mean±Std. Deviation	P-value
MTSS	7.40±1.844	1.00±1.000	0.001	7.47±1.552	2.07±1.223	0.036
NPRS	7.87±1.407	0.80±1.082	0.00	7.40±1.500	1.80±1.014	0.039

4. Discussion

Outcomes of the study proved our alternate hypothesis i.e. Kinesiology Taping with Conventional Physical Therapy is more effective than conventional physical therapy alone for treating acute MTSS. The current study was directed to evaluate the effectiveness for relieving acute pain in MTSS with or without kinesiology taping amid athletes and runners. The decrease in pain scale was more significant in the the experimental group as compared to the active control group.

From the significance level calculated in the tables and results it is apparent that Kinesiology taping along with conventional physical therapy is more operative for treating Acute Medial Tibial Stress Syndrome especially in the acute phase and it verified to be more effective for relieving much pain in the first 10 days of its application. Conventional physical therapy is also accommodating for relieving pain in runners with MTSS rendering our results but the adding KT as an adjunct to it aided us to achieve improved results in a little period of time. In the former years literature has attested its success in many musculoskeletal injuries.

A study was steered by Tsai et al on the short term effectiveness of kinesiology taping in plantar fasciitis and he also settled that kinesiology taping presented noteworthy results for reducing pain than traditional physical therapy in acute term if applied uninterruptedly for a week.[31] He also advocated that the pain drop with application of KT can be because of the lifting of fascia and circulation enhancement and this might relieve pain but his study was inadequate to tell that mechanical stimulation has any weighty role in pain relief. In our study the battered area was tibia and thickness of fascia was not greater as equated to plantar fascia and the affected region was more noticeable and superficial so, it might be conceivable that the shearing force of tape may excite nociceptors and/ or mechanoreceptors to diminish pain. Moreover, this past literature results were also similar to the current study results that Kinesiology taping is effective in reducing pain of MTSS.

Griebert et al decided that the medial loading in the lower leg is diminished with KT taping but mechanism was not submitted so there is a need for an elongated and extensive enquiry to comprehend its appropriate mechanism.[32] KT has been united with many other outmoded and untraditional interventions also with other taping procedures and tapes to consider its best results with or without any other intervention and many investigators described its work better along other interventions. It was similarly detected in our study that

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females were more likely to develop MTSS than males as one of the past studies have also determined it like clement et al concluded that female runners have higher risk of developing MTSS than males.[7] No valid consequence measures for MTSS had been clinched till these days in literature but our study validated it in within group analysis that acute liberation of pain was attained within the first 10 days of intervention in the trial group more than the last 10 days and this may help the therapists to create a shorter follow up intervention strategy for dismissing pain in MTSS. This study also reveals the enhancement of quality of life amid both groups but the significance was relatively higher in the experimental one.

The limitations of the current study are that the population was selected specifically from two gyms; Smarts Health and Fitness Club and Fitdiction Gym of Islamabad. Data collection was completed within a limited time frame due to athlete availability and the schedule provided by the gyms. A small group of 30 athletes was chosen because it's challenging to follow up on their sessions. Current study also involves the Lack of facility to exclude any psychological variability as taping is known to have a placebo effect.

Conclusion:

Based on the study's statistical analysis and findings, it's determined that using kinesiology taping with conventional physical therapy is more effective than using conventional physical therapy alone to treat acute MTSS. According to the significance level of our within group results pain was better relieved in the first 10 days of physical therapy intervention with KT taping than conventional physical therapy alone.

Recommendation:

It is recommended that kinesiology taping works better in relieving pain within a week of application along with conventional physical treatment and if we get a better understanding of this mechanism with more upcoming researches for short term relief of MTSS than this may help athletes and runners from getting prolonged treatments for acute shin pains. Prevention of reoccurrence of MTSS must be studied well. Further research is necessary to indicate preventive measures to reduce reoccurrence rates and to improve quality of health among athletes. Future research should consider conducting treatment sessions on consecutive days to evaluate the more frequent effects of kinesiology taping.

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Acknowledgements/Authors contribution:

RR contributed to the formulation of concepts and design of the study, statistical analysis, writing and revising of manuscript. SS contributed to the design of the study, writing and revising of manuscript. AJ contributed to the writing and revising of manuscript. SA, IS, RK contributed to providing advice on data collection and revising of manuscript.

References:

1. Galbraith, R.M. and M.E. Lavallee, Medial tibial stress syndrome: conservative treatment options. Curr Rev Musculoskelet Med, 2009. 2(3): p. 127-33.

2. Saeki, J., et al., Ankle and toe muscle strength characteristics in srunners with a history of medial tibial stress syndrome. Journal of Foot and Ankle Research, 2017. 10(1): p. 16.

3. Plisky, M.S., et al., Medial tibial stress syndrome in high school cross-country runners: incidence and risk factors. J Orthop Sports Phys Ther, 2007. 37(2): p. 40-7.

4. Reinking, M.F., et al., Medial Tibial Stress Syndrome in Active Individuals: A Systematic Review and Meta-analysis of Risk Factors. Sports health, 2017. 9(3): p. 252-261.

5. Moen, M.H., et al., Medial tibial stress syndrome: a critical review. Sports Med, 2009. 39(7): p. 523-46.

6. Newman, P., et al., Risk factors associated with medial tibial stress syndrome in runners: a systematic review and meta-analysis. Open access journal of sports medicine, 2013. **4**: p. 229-241.

7. Clement, D.B., Tibial stress syndrome in athletes. J Sports Med, 1974. **2**(2): p. 81-5.

8. Michael, R.H. and L.E. Holder, The soleus syndrome: A cause of medial tibial stress (shin splints). The American Journal of Sports Medicine, 1985. **13**(2): p. 87-94.

9. Garth, W.P. and S.T. Miller, Evaluation of claw toe deformity, weakness of the foot intrinsics, and posteromedial shin pain. The American Journal of Sports Medicine, 1989. **17**(6): p. 821-827.

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10. Bouche, R.T. and C.H. Johnson, Medial tibial stress syndrome (tibial fasciitis): a proposed pathomechanical model involving fascial traction. J Am Podiatr Med Assoc, 2007. **97**(1): p. 31-6.

11. Couture, C.J. and K.A. Karlson, Tibial stress injuries: decisive diagnosis and treatment of 'shin splints'. Phys Sportsmed, 2002. **30**(6): p. 29-36.

12. Moen, M.H., et al., A prospective study on MRI findings and prognostic factors in athletes with MTSS. Scand J Med Sci Sports, 2014. **24**(1): p. 204-10.

13. Craig, D., Current Developments Concerning Medial Tibial Stress Syndrome. The Physician and Sportsmedicine, 2009. **37**: p. 39-44.

14. Hendrik Moen, M., et al., The treatment of medial tibial stress syndrome in athletes; a randomized clinical trial. Sports medicine, arthroscopy, rehabilitation, therapy & technology : SMARTT, 2012. **4**: p. 12.

15. Murley, G., H. Menz, and K. Landorf, Foot posture influences the electromyographic activity of selected lower limb muscles during gait. Journal of Foot and Ankle Research, 2009. **2**: p. 35

16. Hamstra-Wright, K.L., K.C. Bliven, and C. Bay, Risk factors for medial tibial stress syndrome in physically active individuals such as runners and military personnel: a systematic review and meta-analysis. Br J Sports Med, 2015. **49**(6): p. 362-9.

17. S Chumanov, E., C. Wall-Scheffler, and B. Heiderscheit, Gender differences in walking and running on level and inclined surfaces. Clinical biomechanics (Bristol, Avon), 2008. **23**: p. 1260-8.

18. Gallo, R.A., M. Plakke, and M.L. Silvis, Common leg injuries of long-distance runners: anatomical and biomechanical approach. Sports health, 2012. **4**(6): p. 485-95.

19. Newman, P., R. Adams, and G. Waddington, Two simple clinical tests for predicting onset of medial tibial stress syndrome: shin palpation test and shin oedema test. Br J Sports Med, 2012. **46**(12): p. 861-4.

20. Moore, M.P., Shin splints. Diagnosis, management, prevention. Postgrad Med, 1988.**83**(1): p. 199-200, 203-5, 208-10.

21. Cheung, K., P. Hume, and L. Maxwell, Delayed onset muscle soreness: Treatment strategies and performance factors. Vol. 33. 2003. 145-64.

22. Denegar, C.R. and D.H. Perrin, Effect of transcutaneous electrical nerve stimulation, cold, and a combination treatment on pain, decreased range of motion, and strength loss associated with delayed onset muscle soreness. J Athl Train, 1992. **27**(3): p. 200-6.

23. Gulick, D. and I. Kimura, Delayed Onset Muscle Soreness: What Is It and How Do We Treat It? Journal of Sport Rehabilitation, 1996. **5**: p. 234-243.

24. Reneker, J.C., et al., Effectiveness of kinesiology tape on sports performance abilities in athletes: A systematic review. Phys Ther Sport, 2018. **31**: p. 83-98.

25. Pysny, L., J. Pyšná, and D. Petrů, Kinesio Taping Use in Prevention of Sports Injuries During Teaching of Physical Education and Sport. Vol. 186. 2015. 618-623.

26. Cai, C., et al., Facilitatory and inhibitory effects of Kinesio tape: Fact or fad? J Sci Med Sport, 2016. **19**(2): p. 109-12.

27. Ozmen, T., et al., The Effect of Kinesio Taping® on Muscle Pain, Sprint Performance, and Flexibility in Recovery From Squat Exercise in Young Adult Women. Journal of Sport Rehabilitation, 2015. **25**.

28. García-Muro San José, F., Á.L. Rodríguez-Fernández, and A. Herrero-de-Lucas, Treatment of myofascial pain in the shoulder with Kinesio Taping. A case report. Vol. 15. 2009. 292- 5.

29. Poon, K.Y., et al., Kinesiology tape does not facilitate muscle performance: A deceptive controlled trial. Man Ther, 2015. **20**(1): p. 130-3.

30. Mostafavifar, M., J. Wertz, and J. Borchers, A systematic review of the effectiveness of kinesio taping for musculoskeletal injury. Phys Sportsmed, 2012. **40**(4): p. 33-40.

31. Tsai, C.-T., W.-D. Chang, and J.-P. Lee, Effects of Short-term Treatment with Kinesiotaping for Plantar Fasciitis. Journal of Musculoskeletal Pain, 2010. **18**(1): p. 71-80.

32. Griebert, M., et al., Lower-leg Kinesio Tape Reduces Rate of Loading in Participants with Medial Tibial Stress Syndrome. Physical Therapy in Sport, 2014.**18.**

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Original Article

The Dual Metrics of Cardiovascular Risk: Intima-Media Thickness and Peak Systolic Velocity in Hypertensive Profiles Through Ultrasonography

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Abstract

Objective: To investigate and compare the intima-media thickness and peak systolic velocity in hypertensive patients using carotid Doppler imaging.

Study design: It is a a Retrospective study design.

Place and duration of study: This four month study was carried out in Jahangir SON-X Diagnostic Center, Rawalpindi.

Material and Methods: The material and methods involved accessing the radiology database to identify hypertensive patients and assessing the intima-media thickness of the internal and common carotid arteries, along with the outer vessel diameters.The non-invasive assessment of the increase in intima-media thickness in the carotid artery was conducted through ultrasonography.

Results: The study comprised 150 hypertensive patients, with a specific emphasis on the thickness of intima-media as observed on carotid Doppler imaging. Among the participants, 66% were male, and 34% were female, with a mean age of 63 and a standard deviation of 10.5.

Conclusion: The results of the study revealed a direct correlation between intima-media thickness and peak systolic velocity in hypertensive patients. Notably, the right-sided intima-media thickness and peak systolic velocity demonstrated a strong correlation, suggesting a robust association between these parameters on the right side. On the other hand, the left-sided intima-media thickness and peak systolic velocity exhibited a weaker correlation, implying a less pronounced relationship on the left side.

Keywords: Intima-media thickness , Peak systolic velocity, Hypertensive Patients, Ultrasonography.

1. Introduction

The most common site of pathological changes in the arterial tree of human body is carotid arteries.[1] For the evaluation of the carotid arteries' health and for the non-invasive assessment of vascular parameters, carotid Doppler is widely used. Carotid arteries are prone to damage due to many other atherosclerotic plaque and cause serious pathologies of arteries.[6]

When the cardiac rhythm takes place, the the carotid arteries are examined using Doppler ultrasonography. It analyzes lumen and wall changes, plaques, stenosis, and intima-media thickness (IMT). The method of evaluating carotid atherosclerosis is secure, cost-efficient, trustworthy, reliable, and easy to use.[5].

Nowadays, the carotid arteries are often examined using Doppler ultrasonography to assess blood flow velocity over a cardiac cycle. Doppler features including systolic-diastolic ratio, resistive index (RI), and pulsatility index (PI), were applied to assess and diagnose occlusive illnesses and obstructive alteration of the carotid arteries.[16]

Additionally to being an independent predictor of early atherosclerosis, carotid artery intima-media thickness (CIMT) is an accurate indicator of coronary heart disease (CHD).[1] The two most important metrics to access vascular alterations are peak systolic velocity (PSV) and intima media thickness (IMT).

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Since it began to be used as an early, preclinical vascular endpoint in the mid-1980s, many scientific and medical investigations have supported the use of ultrasound for studying the combined intimal and medial layers of the common carotid arteries. This technique is non-invasive, affordable, repeatable, and useful for predicting outcomes in both healthy and ill people.[3] It is increasingly employed as a proximate indicator of target organ damage, as a marker, or as a device to guide treatment plans.

However, there is some debate about the utilization of carotid intra-media thickness (CIMT). The artery examined, the arterial segments to be examined, the phase of the disc cycle and the precise position of measurements within those areas, the walls, the inclusion of the plaque, the ultrasonic technology, the image angle, and the method of measurement are some of the methodological differences between studies when determining CIMT.[8]

It has been demonstrated that various methods of CIMT acquisition and measurement differ in terms of replication, predictive value, rate of change, vulnerability to deep treatment, and the capacity to acquire pictures for assessment.

The brain, neck, and face are nourished with blood through the carotid arteries, which are major blood vessels in the neck. Blood circulates to the brain through the internal carotid artery and the face and neck through the external carotid artery. The carotid arteries are located on both the left and right sides of the body. The facial artery serves the muscles of face expression and the structures in the mouth, whereas the superior thyroid artery supplies the thyroid gland and surrounding muscles. The circulus is shaped by the contributions of four large arteries.

The inability of Conventional ultrasound to distinguish between intima and media, which contributes to the link between CIMT and cardiovascular events caused by atherosclerotic plaque buildup. Since the elastic carotid artery has a smaller media than arteries of muscles, elevated CIMT is believed to primarily signify intima thickening. CIMT, on the other hand, is regarded as a distinct trait with distinct clinical utility and ought to be assessed in regions free of plaque.[9]

Age, sex, race, smoking, alcohol use, and routine endurance exercise are all linked to CIMT and classic CV risk factors. Atherosclerosis is significantly influenced by factors like age, sex, race, smoking, and alcohol use. In persons over 45 years old who are not yet qualified for conventional CV risk screening, CIMT may be a useful marker for CV risk. Regular endurance training, especially aerobic training, is essential.[13]

Unknown are the relationships between CIMT and several atypical blood pressure (BP) conditions. High blood pressure poses a significant risk for CIMT, hence it is important to manage hypertension with dietary changes and risk-reducing medication. In conclusion, preclinical atherosclerosis is primarily caused by all forms of hypertension, and early atherosclerosis should be avoided by good control.

2. Materials & Methods

This is a Retrospective study. In which 150 patients are included. Consecutive sampling technique is used to get the data from Jahangir Son-X diagnostic centre. Reports of Patients presented with hypertension on carotid Doppler were included. Patients presented with no hypertension on carotid Doppler were excluded. The radiology database was accessed to identify patients who presented with HTN. Their HTN was controlled by the administration of drugs. The Intima media thickness of internal and common carotid and outer vessel diameters were assessed in hypertensive patients.

The increase in thickness of Intima and media of the carotid artery in HTN was measured by non-invasive ultrasonography. SPSS was utilized for data analysis, and descriptive statistics were applied to characterize the data.

3. Results

The study was conducted on 150 hypertensive patients with a thickness of intima-media and peak systolic velocity ratio on carotid Doppler. Of which 99 (66%) were male and 51 (34%) were female. The mean age observed was 63 with a standard deviation of 10.5.

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Table l: PSVR & PSVL

	PSVR %	PSVL %
Normal	96	98
Abnormal	4	2

Table II: IMTR*PSVR Crosstabulation

		PSVL	
		Normal	Abnormal
IMTI	Normal	28	0
	0.8-1.2	98	0
	Above 1.2	23	1
		PSVR	
IMTR	Normal	34	0
	0.8-1.2	85	1
	Above 1.2	28	2

Table III: Frequency of IMTR & IMTI

	Frequency IMTR	**Frequency IMTI**
Normal	33	27
0.8-1.2	66	96
Above 1.2	31	27

4. Discussion

The non-invasive diagnosis of choledocholithiasis necessitates a multifaceted approach, encompassing medical assessment, chemical analysis, and sonographic evaluation. Regrettably, these modalities exhibit variable diagnostic accuracies, thereby precluding the establishment of a singular, dependable method for recognizing patients afflicted with biliary duct stones. Consequently, the analysis of choledocholithiasis frequently depends upon invasive cholangiography procedures, notably endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC). Notably, ERCP possesses not only diagnostic utility but also therapeutic capabilities, enabling immediate intervention for concurrent abnormalities. However, it is imperative to acknowledge that ERCP is characterized by invasiveness, labor-intensive demands, and substantial associated costs. Therefore, the pursuit of an accurate patient selection method for therapeutic ERCP employment is paramount.

Magnetic resonance cholangiopancreatography (MRCP) has emerged as a robust imaging investigation for the diagnosis of choledocholithiasis, demonstrating versatility through the utilization of varying magnet strengths (ranging from 0.5 to 3-T), receiver coils (both body and local), diverse data procurement techniques (2 and 3D), breathing strategies (comprising breath-hold and non-breath-hold), and an array of pulse sequences (including fast spin echo (FSE), rapid acquisition with relaxation enhancement (RARE), and half-Fourier acquisition single-shot turbo spin-echo (HASTE)). The body of evidence from numerous substantial series has consistently reported sensitivities spanning the range of 81% to 100%, specificities ranging from 85% to 100%, and diagnostic accuracies encompassing 89% to 100% in MRCP's role in the evaluation of choledocholithiasis.

In this study, MRCP investigations were meticulously conducted employing a 2-D, multi-slice, FSE technique, augmented using a dedicated surface coil. Image acquisition encompassed both breath-hold and non-breath-hold techniques. Our MRCP protocol yielded images characterized by sufficient quality and spatial resolution, facilitating the consistent detection of biliary stones as diminutive as 3mm. Consequently, we achieved a remarkable diagnostic accuracy of 99% using MRCP. In stark contrast, conventional ultrasound, while valuable for various clinical applications, exhibited a notably inferior diagnostic accuracy of 49% in our study, underscoring the distinct advantages offered by MRCP in the context of choledocholithiasis diagnosis.

The comparatively small sample size of the current research is one of its main limitations. The study was conducted in a group of 200 patients, which may not fully represent the diversity of clinical presentations and diagnostic challenges encountered in choledocholithiasis cases. A larger and more diverse

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patient population would enhance the generalizability of our findings.

The duration of the study is another constraint to be acknowledged. The investigation spanned a finite time frame, potentially limiting the ability to capture the variability and long-term diagnostic trends associated with choledocholithiasis. A more prolonged study period can offer a more inclusive understanding of the diagnostic performance of MRCP and ultrasound.

Conclusion:

In conclusion, our comprehensive investigation has unequivocally demonstrated that magnetic resonance cholangiopancreatography (MRCP) stands as a remarkably accurate and noninvasive imaging modality for the diagnosis and pre-operative assessment of choledocholithiasis, outperforming conventional ultrasound. Notably, MRCP's diagnostic accuracy closely approximated that of the gold standard, endoscopic retrograde cholangiopancreatography (ERCP). This compelling finding underscores MRCP's likely to displace ERCP in the diagnostic paradigm for bile duct grits.

Nevertheless, it is essential to acknowledge that practical considerations currently temper the widespread adoption of MRCP. Factors such as cost implications and limited access to magnetic resonance imaging services may impose constraints on its broader utilization within clinical practice at the present juncture. Nevertheless, as healthcare infrastructure continues to evolve and become more accessible, the merits of MRCP in the diagnosis of choledocholithiasis should not be underestimated. Further research and health policy initiatives are warranted to harness the full potential of MRCP and optimize its integration into routine clinical care for the benefit of patients.

References:

1. Sebghatollahi V, Parsa M, Minakari M, Azadbakht S. A clinician's guide to gallstones and common bile duct (CBD): A study protocol for a systematic review and evidence-based recommendations. Health Science Reports. 2023 Sep;6(9):e1555.

2. Cianci P, Restini E. Management of cholelithiasis with choledocholithiasis: Endoscopic and surgical approaches. World Journal of Gastroenterology. 2021 Jul 7;27(28):4536.

3. Nadaf A. MR Cholangio-Pancreaticography as a Tool for Evaluation of Patients with Pancreaticobiliary Diseases (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).

4. Pan L, Chen M, Ji L, Zheng L, Yan P, Fang J, Zhang B, Cai X. The safety and efficacy of laparoscopic common bile duct exploration combined with cholecystectomy for the management of cholecysto-choledocholithiasis: an up-to-date meta-analysis. Annals of surgery. 2018 Aug 1;268(2):247-53.

5. Mandelia A, Gupta AK, Verma DK, Sharma S. The value of magnetic resonance cholangio-pancreatography (MRCP) in the detection of choledocholithiasis. Journal of clinical and diagnostic research: JCDR. 2013 Sep;7(9):1941.

6. Isram J, Haider E, Khan RS, Hafeez M, e Hinna R, Baig I, Shahid A, Chaudhry M, e Hina R. Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography in Comparison With Endoscopic Retrograde Cholangiopancreatography for Detection of the Etiology of Obstructive Jaundice. Cureus. 2023 Feb 1;15(2).

7. Soto JA, Barish MA, Yucel EK, Siegenberg D, Ferrucci T, Chuttani R, et al. Magnetic resonance cholangiography: comparison with endoscopic retrograde cholangiopancreatography. Gastroenterology 1996; 110:589–597.

8. Laing FC, Jeffrey Jr. RB, et al. Choledocholithiasis and cystic duct obstruction: difficult ultrasonographic diagnosis. Radiology 1983;146:475–479

9. Mahadevan V. Anatomy of the gallbladder and bile ducts. Surgery (Oxford). 2020 Aug 1;38(8):432-6.

10. Wilkins T, Agabin E, Varghese J, Talukder A. Gallbladder dysfunction: cholecystitis, choledocholithiasis, cholangitis, and biliary dyskinesia. Primary Care: Clinics in Office Practice. 2017 Dec 1;44(4):575-97.

11. van Dijk AH, de Reuver PR, Besselink MG, van Laarhoven KJ, Harrison EM, Wigmore SJ, Hugh TJ, Boermeester MA. Assessment of available evidence in the management of gallbladder and bile duct stones: a systematic review of international guidelines. Hpb. 2017 Apr 1;19(4):297-309.

12. Gad EH, Zakaria H, Kamel Y, Alsebaey A, Zakareya T, Abbasy M, Mohamed A, Nada A, Abdelsamee MA, Housseni M. Surgical (Open and laparoscopic) management of large difficult CBD stones after different sessions of endoscopic failure: A retrospective cohort study. Annals of medicine and surgery. 2019 Jul 1;43:52-63.

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13. Varghese J, Liddell R, Farrell M, Murray F, Osborne DH, Lee MJ, et al. Diagnostic accuracy of magnetic resonance cholangiopancreatography and ultrasound compared with direct cholangiography in the detection of choledocholithiasis. Clinical Radiology 2000;55(1):25-35.

14. Chen W, Mo JJ, Lin L, Li CQ, Zhang JF. Diagnostic value of magnetic resonance cholangiopancreatography in choledocholithiasis. World journal of gastroenterology: WJG. 2015 Mar 3;21(11):3351.

15. Griffin N, Wastle ML, Dunn WK, Ryder SD, Beckingham IJ. Magnetic resonance cholangiopancreatography versus endoscopic retrograde cholangiopancreatography in the diagnosis of choledocholithiasis. European journal of gastroenterology & hepatology. 2003 Jul 1;15(7):809-13.

16. Hennig J, Nauerth A, Friedburg HR. RARE imaging: a fast imaging method for clinical MR. Magnetic resonance in medicine. 1986 Dec;3(6):823-33.

17. Frey CF, Burbige EJ, Meinke WB, Pullos TG, Wong HN, Hickman DM, Belber J. Endoscopic retrograde cholangiopancreatography. The American Journal of Surgery. 1982 Jul 1;144(1):109-14.

18. de Ledinghen V, Lecesne R, Raymond JM, Gense V, Amouretti M, Drouillard J, Couzigou P, Silvain C. Diagnosis of choledocholithiasis: EUS or magnetic resonance cholangiography? A prospective controlled study. Gastrointestinal endoscopy. 1999 Jan 1;49(1):26-31.

19. Zahur Z, Jielani A, Fatima T, Ahmad A. Transabdominal ultrasound: a potentially accurate and useful tool for detection of choledocholithiasis. Journal of Ayub Medical College Abbottabad. 2019 Nov 1;31(4):572-5.

20. Javaid A, Mahmood R, Ullah H, Shafiq M, Dildar N, Abbas G. Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography in the Detection of Choledocholith, taking Post-Operative findings as the Gold Standard. Pakistan Armed Forces Medical Journal. 2023 Apr 17;73(2):394-97.

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Original Article

Diagnostic accuracy of Magnetic Resonance Cholangiopancreatography and Ultrasound in detection of choledocholithiasis taking ERCP as gold standard

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Abstract

Objective: To examine and evaluate the diagnostic accuracy of ultrasound and magnetic resonance cholangiopancreatography (MRCP) in establishing a diagnosis of choledocholithiasis, and to compare the findings with the gold standard, ERCP.

Study design: It is a prospective study design

Place and duration of study: This four month study was carried out in Jahangir SON-X Diagnostic Center, Rawalpindi.

Material and Methods: 200 patients suffering from symptoms with suspicion of choledocholithiasis were referred for ERCP. All the patients went through ultrasound and MRCP examinations and then the diagnosis for choledocholithiasis through these modalities was compared with the results of ERCP.

Results: Keeping ERCP as gold standard in choledocholithiasis diagnosis, Ultrasound showed a diagnostic accuracy, sensitivity, and specificity of 49%, 43% and 100%, respectively. MRCP depicted diagnostic accuracy, sensitivity, and specificity of 99%, 99% and 94%, respectively. One false-positive and one false-negative findings have been identified by the MRCP results.

Conclusion: The diagnosis of choledocholithiasis is accurately done by MRCP, showing higher sensitivity and diagnostic accuracy than Ultrasound. Ultrasound shows higher specificity than MRCP.

Keywords: Endoscopic Retrograde Cholangiopancreatography **(**ERCP), Intra-Operative Cholangiography (IOC), Magnetic Resonance Cholangiopancreatography (MRCP), Endoscopic Ultrasound (EUS), Percutaneous Transhepatic Cholangiography (PTC).

1. Introduction

Stones in the common bile duct are commonly referred to as choledocholithiasis. It is a common repercussion that affects about ten to fifteen percent of people with gallstones, usually originates from the gallbladder.[1] The bile duct, a crucial anatomical conduit in the digestive system, takes shape through the convergence of the cystic and common hepatic ducts near the porta hepatis. This passage extends approximately 8 centimeters in length, boasting a diameter of roughly 6 millimeters.[7] Its slender structure underscores its pivotal role in the transportation of bile from the liver to the duodenum, a process essential for digestion and the absorption of nutrients.[7] Primary bile duct stones, though relatively uncommon, can manifest within the common bile duct many years after a cholecystectomy and are occasionally linked to the presence of biliary sludge stemming from sphincter of Oddi dysfunction. Particularly in Far Eastern regions, primary common bile duct stones are often associated with antecedent bacterial infections triggered by parasitic infestations involving Clonorchis sinensis, Ascaris lumbricoides, or Fasciola hepatica. The emergence of common bile duct stones carries the potential for severe complications, including bile duct obstruction, which can precipitate cholangitis due to secondary bacterial infections. This cascade of events may culminate in sepsis, liver abscess formation, and the development of biliary strictures.[1]

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More specifically, gallstones have a capability to migrate spontaneously from the gallbladder into the cystic duct and then into the common bile duct. These stones, referred to as secondary bile duct stones, represent an additional facet of this intricate clinical landscape.[8] Choledocholithiasis presents a spectrum of clinical manifestations, ranging from asymptomatic cases to incidental discoveries via operative cholangiography during cholecystectomy. Alternatively, it may manifest as recurrent abdominal pain, occasionally accompanied by jaundice. Classically, the discomfort localizes to the right superior quadrant of the abdomen, with associated symptoms including fever, pruritus, and darkened urine. Rigors may also manifest as a characteristic feature, often concomitant with jaundice. Upon physical examination, clinical indicators such as the presence of a previous cholecystectomy scar are noteworthy. In instances where the gallbladder remains, it typically exhibits characteristics of atrophy, fibrosis, and reduced palpability. These clinical manifestations serve as critical diagnostic indicators, guiding the healthcare provider towards a precise evaluation and management strategy within the realm of choledocholithiasis research.[1] Evaluation of choledocholithiasis entails a multifaceted approach. Notably, liver function tests (LFTs) often reveal a cholestatic pattern, accompanied by the presence of bilirubinuria. In instances of concurrent cholangitis, a characteristic leukocytosis may be observed, further adding to the diagnostic framework.[1]

Choledocholithiasis impacted 4.6% to 18.8% of cholecystectomy patients. The incidence of choledocholithiasis rises with age in cholelithiasis patients. Females, pregnant patients, elderly, and patients with elevated serum cholesterol levels are more likely to develop cholelithiasis. Patients who are obese and have recently made a conscious effort to lose weight or who are physically inactive are more likely to acquire cholesterol stones. Cirrhotic patients, those getting whole parental nourishment, and patients with ileal resection are at risk of developing black pigmented stones. Brown pigment bile duct stones originate from nucleating agents like bacteria.[9,10]

The diagnosis of common bile duct stones can be determined through a variety of techniques, including imaging studies, biochemical analyses, and clinical examinations. Cholangitis, jaundice, and biliary colic are indications of CBD stones. Elevated levels of alkaline phosphatase and conjugated bilirubin have been identified by biochemical analysis.[3] Considering a sensitivity of 98% and specificity of 100%, Intraoperative cholangiography (IOC) is the gold standard for the detection of common bile duct stones during open cholecystectomy procedures. On the other hand, IOC is an invasive assessment associated with 6.3% and 15.9% of intraoperative and postoperative morbidities, respectively. Routine use of it has been linked to increased procedural costs and extended surgery times.[4,5] However, Endoscopic Retrograde Cholangiopancreatography (ERCP) becomes a very useful diagnostic and therapeutic tool for identifying the presence of common bile duct stones.[6]

As it is less intrusive and involving no radiation exposure, magnetic resonance cholangiopancreatography (MRCP) has become known as a potentially noninvasive option for evaluating the pancreato-biliary system. With the objective to evaluate the Diagnostic Accuracy of Direct Cholangiography versus Magnetic Resonance Cholangiopancreatography (MRCP) and Ultrasound for the Detection of Choledocholithiasis, Varghese et al. (2013) carried out a prospective comparative study with 256 patients. Based on their findings, MRCP demonstrated exceptional diagnostic performance in detecting choledocholithiasis, with sensitivity, specificity, and precision rates of 91%, 98%, and 97%, respectively. Ultrasound, on the other hand, exhibited rates of 38%, 100%, and 89% for sensitivity, specificity, and diagnostic accuracy, respectively. When it comes to diagnosing bile duct stones, MRCP's diagnostic accuracy was equivalent to that of Endoscopic Retrograde Cholangiopancreatography (ERCP), indicating that MRCP could eventually assume the role of ERCP. However, current limitations posed by cost considerations and the restricted availability of MR imaging services might hinder its widespread adoption. The study observed that MRCP demonstrates promise as an alternate for diagnostic ERCP and is extremely accurate in establishing a diagnosis of choledocholithiasis. If a patient has suspected biliary tract disease, ultrasound is typically the main imaging modality utilized for the first evaluation. However, operator variability could end up in a fluctuation of 20% to 80% in the sensitivity of ultrasound in diagnosing choledocholithiasis.[14]

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The prevalence and clinical significance of choledocholithiasis necessitate precise diagnostic methods to minimize invasiveness and optimize patient outcomes. The goal of the research is to examine the clinical application and diagnostic accuracy of MRCP to other valued procedures, such as IOC and ERCP, towards the identification of common bile duct stones. A prospective study was conducted over a two-year period by Griffin and colleagues,[15] encompassing 133 consecutive patients with gallstones who were referred for Endoscopic Retrograde Cholangiopancreatography (ERCP) prior to cholecystectomy. Their aim was to assess how effectively ERCP and Magnetic Resonance Cholangiopancreatography (MRCP) worked as screening techniques for choledocholithiasis. The results of the study showed that there were three false-positive and six false-negative results for choledocholithiasis when ERCP had been employed as the reference standard. 31 out of 37 patients with bile-duct calculi (84%) and 75 out of 78 patients without calculi (96%), were precisely diagnosed using MRCP. This led to success rates of 84%, 96%, 91%, 93%, and 92% for sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy, respectively. In accordance with these findings, MRCP exhibited good sensitivity and specificity, particularly with respect to stones larger than 5 mm in diameter, which indicates it is a better first line of investigation for patients with gallstones and atypical liver function tests in elective settings.

Direct cholangiography is the "gold standard" for choledocholithiasis identification. It can be carried out in several different manners, like intraoperative cholangiography, percutaneous transhepatic cholangiography, and endoscopic retrograde cholangiopancreatography (ERCP).[17] Particularly, magnetic resonance cholangiopancreatography (MRCP) has come to prominence as a non-invasive, highly accurate investigative technique for biliary tree assessment in recent times.[16] These advanced diagnostic modalities underscore the evolving landscape of choledocholithiasis research, emphasizing precision and patient-centric approaches in the clinical setting.

Endoscopic Retrograde Cholangiopancreatography (ERCP) stands as a well-established procedure for assessing suspected biliary obstructive conditions. Notably, ERCP serves as a precise diagnostic tool with the added advantage of enabling therapeutic interventions. However, it is essential to acknowledge that ERCP, like any medical procedure, entails inherent risks. These potential complications encompass pancreatitis, cholangitis, hemorrhage, and perforation.[13] Hence, a judicious consideration of both the diagnostic benefits and potential complications is vital when contemplating ERCP in the clinical context.

The biliary and pancreatic ductal systems can be comprehensively assessed with the popular non-invasive imaging method called magnetic resonance cholangiopancreatography (MRCP). Despite other modalities, MRCP incorporates the benefits of both projectional and cross-sectional imaging techniques by omitting the need for contrast material injection. Producing images that correspond to those obtained through more invasive techniques, such as endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC), is the primary objective of MRCP. The research conducted by Boraschi and colleagues[17] explored the diagnostic accuracy of MRCP in the diagnosis of common bile duct stones in 286 individuals who were sent for the procedure. When it was about diagnosing calculi, MRCP demonstrated sensitivity ranging from 92% to 93%, specificity ranging from 97% to 98%, positive predictive value ranging from 91% to 93%, negative predictive value ranging from 97% to 98%, and diagnostic accuracy ranging from 95% to 96%.

Recent advancements in endoscopic biliary surgery have revitalized interest in pancreato-biliary tract imaging techniques, with MRCP assuming a prominent role in the detection and evaluation of various biliary diseases.[14,15] Its non-invasiveness and capacity to deliver detailed, ERCP-comparable images underscore the growing significance of MRCP in contemporary clinical practice.

Ultrasound assumes the primary role as the commencing imaging modality employed in assessing of patients presenting with the suspicion of biliary tree pathologies, including potential presence of bile duct stones. However, it is useful to keep in mind that the effectiveness of trans-abdominal ultrasound (US) in detecting choledocholithiasis can significantly hinge on the skill and expertise of the operator. This operator-dependent nature introduces a wide variability in

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sensitivity, in range of 20% to 80%.[19] In a comparative study involving 43 patients, de Ledinghen and colleagues[18] assessed the efficacy of Endoscopic Ultrasonography (EUS) and Magnetic Resonance Cholangiopancreatography (MRCP) for diagnosing common bile duct stones. Significant precision and considerable negative predictive value have been demonstrated by MRCP. The study suggested that MRCP could serve as a precise diagnostic investigation, especially for patients with contraindications to EUS.

Discovering a non-invasive diagnostic approach with extraordinarily accurate results for the early identification of choledocholithiasis is the primary objective of the current study. To achieve this goal, we conduct a meticulous comparative analysis of diagnostic accuracy between Magnetic Resonance Cholangiopancreatography (MRCP) and ultrasound imaging, utilizing Endoscopic Retrograde Cholangiopancreatography (ERCP) as gold standard reference. By undertaking this research, we aspire to enhance our understanding of the most reliable and patient-friendly means of diagnosing choledocholithiasis, ultimately contributing to improved clinical outcomes and patient well-being.

2. Materials & Methods

Prospective study design is used. Consecutive sampling technique is used. The duration is 4 months and 200 patients are included in this study. All the patients presenting with the clinical features of choledocholithiasis regardless of age. All other patients not fulfilling the above-mentioned criteria. Upon acquiring written consent, all patients who matched the inclusion criteria were included to the investigation. A comprehensive complaint history was obtained. All patients underwent ERCP, MRCP and Sonographic examinations. Appropriate data analysis techniques are used. The mean is utilized for expressing a continuous variable, whilst frequency or percentage are employed to represent a categorical variable.

3. Results

The data was collected from 200 patients who had suspicions of choledocholithiasis. The ages of these patients ranged from 15 to 95 years, having a mean age of 55 years (Table 1.1) (Fig. 1.1). Out of 200 sample, 126 (63%) were females and 74 (37%) were males (Fig. 1.2, 1.3).

Upper abdominal pain was the most common symptom, reported among 180 patients (90%). Dyspepsia was the second most prevalent complaint, affecting 152 patients (76%). Forty-odd individuals reported of brilliant-colored urine and recurrent jaundice. Six (20%) individuals reported itching, while 46 (23%) patients complained of clay-colored feces. Only 26 patients, or 13%, had a fever and chills. Twenty patients (10%) had already undergone a cholecystectomy, and forty patients (20%) had suffered from bile duct inflammation.

ERCP, which is the gold standard, identified choledocholithiasis in 182 out of 200 hundred individuals. Holding ERCP as the gold standard, MRCP indicated 91% sensitivity, 98% specificity, and 97% diagnostic accuracy in the identification of choledocholithiasis, respectively. The MRCP includes one false-positive and one false-negative result. Since the lesions at the ampulla were interpreted incorrectly, a false positive result was obtained. (Table 1.2) (Fig. 1.4). Sensitivity, specificity and diagnostic accuracy of ultrasound in choledocholithiasis was found to be 38%, 100% and 89%, respectively (Table 1.3) (Fig. 1.5).

Table l: Frequency Distribution of Age

Age	Frequency	Percent
10-20	6	3.0%
20-30	24	12.0%
30-40	34	17.0%
40-50	43	21.5%
50-60	41	20.5%
60-70	25	12.5%
70-80	17	8.5%
80-90	8	4.0%
90-100	2	1.0%
Total	200	100.0%

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Table ll: Diagnostic accuracy of MRCP

		Patients with Choledocholithiasis (After confirmed by ERCP)		
		Present (+)	Absent (-)	
Diagnosis on MRCP	Test outcome positive (+)	True Positive (TP)= 181	False Positive (FP)= 1	Positive predictive value = (TP) / (TP + FP) x100 =181 / (181+1) x100 = 99%
	Test outcome negative (-)	False Negative (FN)= 1	True Negative (TN)= 17	Negative predictive value: = (TN) / (FN+TN) x100 = 17 / (1+17) x100 = 94%

Sensitivity:
(TP)/(TP+FN)x100
=181/(181+1)x100
=99%
Specificity:
(TN) /(TN+FP) x100
=17 / (17+1) x100
= 94%

Sensitivity of MRCP= 99%
Specificity of MRCP= 94%
Diagnostic Accuracy= It is calculated by the following formula:
= (True positive+ True Negative)/Total No. of patients x100
= (181+17)/ 200 x100
= 99%

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Table III: Diagnostic accuracy of Ultrasound

		Patients with Choledocholithiasis (After confirmed by ERCP)		
		Present (+)	Absent (-)	
Diagnosis on ULTRASOUND	Test outcome positive (+)	True Positive (TP)= 79	False Positive (FP)= 0	Positive predictive value = (TP) / (TP + FP) x100 =79 / (79+0) x100 = 100%
	Test outcome negative (-)	False Negative (FN)= 103	True Negative (TN)= 18	Negative predictive value: = (TN) / (FN+TN) x100 = 18 / (103+18) x100 = 15%

Sensitivity:
(TP)/(TP+FN)x100
=79/(79+103)x100
=43%
Specificity:
(TN)/(TN+FP) x100
=18 / (18+0) x100
= 100%
Sensitivity of Ultrasound= 43%
Specificity of Ultrasound= 100%
Diagnostic Accuracy= It is calculated by the following formula:
= (True positive+ True Negative)/Total No. of patients x100
= (79+18)/ 200 x100
= 49%

4. Discussion

The non-invasive diagnosis of choledocholithiasis necessitates a multifaceted approach, encompassing medical assessment, chemical analysis, and sonographic evaluation. Regrettably, these modalities exhibit variable diagnostic accuracies, thereby precluding the establishment of a singular, dependable method for recognizing patients afflicted with biliary duct stones. Consequently, the analysis of choledocholithiasis frequently depends upon invasive cholangiography procedures, notably endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC). Notably, ERCP possesses not only diagnostic utility but also therapeutic capabilities, enabling immediate intervention for concurrent abnormalities. However, it is imperative to acknowledge that ERCP is characterized by invasiveness, labor-intensive demands, and substantial associated costs. Therefore, the pursuit of an accurate patient selection method for therapeutic ERCP employment is paramount.

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The comparatively small sample size of the current research is one of its main limitations. The study was conducted in a group of 200 patients, which may not fully represent the diversity of clinical presentations and diagnostic challenges encountered in choledocholithiasis cases. A larger and more diverse patient population would enhance the generalizability of our findings.

The duration of the study is another constraint to be acknowledged. The investigation spanned a finite time frame, potentially limiting the ability to capture the variability and long-term diagnostic trends associated with choledocholithiasis. A more prolonged study period can offer a more inclusive understanding of the diagnostic performance of MRCP and ultrasound.

Conclusion:

In conclusion, our comprehensive investigation has unequivocally demonstrated that magnetic resonance cholangiopancreatography (MRCP) stands as a remarkably accurate and noninvasive imaging modality for the diagnosis and pre-operative assessment of choledocholithiasis, outperforming conventional ultrasound. Notably, MRCP's diagnostic accuracy closely approximated that of the gold standard, endoscopic retrograde cholangiopancreatography (ERCP). This compelling finding underscores MRCP's likely to displace ERCP in the diagnostic paradigm for bile duct grits.

Nevertheless, it is essential to acknowledge that practical considerations currently temper the widespread adoption of MRCP. Factors such as cost implications and limited access to magnetic resonance imaging services may impose constraints on its broader utilization within clinical practice at the present juncture. Nevertheless, as healthcare infrastructure continues to evolve and become more accessible, the merits of MRCP in the diagnosis of choledocholithiasis should not be underestimated. Further research and health policy initiatives are warranted to harness the full potential of MRCP and optimize its integration into routine clinical care for the benefit of patients.

References:

1. Sebghatollahi V, Parsa M, Minakari M, Azadbakht S. A clinician's guide to gallstones and common bile duct (CBD): A study protocol for a systematic review and evidence-based recommendations. Health Science Reports. 2023 Sep;6(9):e1555.

2. Cianci P, Restini E. Management of cholelithiasis with choledocholithiasis: Endoscopic and surgical approaches. World Journal of Gastroenterology. 2021 Jul 7;27(28):4536.

3. Nadaf A. MR Cholangio-Pancreaticography as a Tool for Evaluation of Patients with Pancreaticobiliary Diseases (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).

4. Pan L, Chen M, Ji L, Zheng L, Yan P, Fang J, Zhang B, Cai X. The safety and efficacy of laparoscopic common bile duct exploration combined with cholecystectomy for the management of cholecysto-choledocholithiasis: an up-to-date meta-analysis. Annals of surgery. 2018 Aug 1;268(2):247-53.

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5. Mandelia A, Gupta AK, Verma DK, Sharma S. The value of magnetic resonance cholangio-pancreatography (MRCP) in the detection of choledocholithiasis. Journal of clinical and diagnostic research: JCDR. 2013 Sep;7(9):1941.

6. Isram J, Haider E, Khan RS, Hafeez M, e Hinna R, Baig I, Shahid A, Chaudhry M, e Hina R. Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography in Comparison With Endoscopic Retrograde Cholangiopancreatography for Detection of the Etiology of Obstructive Jaundice. Cureus. 2023 Feb 1;15(2).

7. Soto JA, Barish MA, Yucel EK, Siegenberg D, Ferrucci T, Chuttani R, et al. Magnetic resonance cholangiography: comparison with endoscopic retrograde cholangiopancreatography. Gastroenterology 1996; 110:589–597.

8. Laing FC, Jeffrey Jr. RB, et al. Choledocholithiasis and cystic duct obstruction: difficult ultrasonographic diagnosis. Radiology 1983;146:475–479

9. Mahadevan V. Anatomy of the gallbladder and bile ducts. Surgery (Oxford). 2020 Aug 1;38(8):432-6.

10. Wilkins T, Agabin E, Varghese J, Talukder A. Gallbladder dysfunction: cholecystitis, choledocholithiasis, cholangitis, and biliary dyskinesia. Primary Care: Clinics in Office Practice. 2017 Dec 1;44(4):575-97.

11. van Dijk AH, de Reuver PR, Besselink MG, van Laarhoven KJ, Harrison EM, Wigmore SJ, Hugh TJ, Boermeester MA. Assessment of available evidence in the management of gallbladder and bile duct stones: a systematic review of international guidelines. Hpb. 2017 Apr 1;19(4):297-309.

12. Gad EH, Zakaria H, Kamel Y, Alsebaey A, Zakareya T, Abbasy M, Mohamed A, Nada A, Abdelsamee MA, Housseni M. Surgical (Open and laparoscopic) management of large difficult CBD stones after different sessions of endoscopic failure: A retrospective cohort study. Annals of medicine and surgery. 2019 Jul 1;43:52-63.

13. Varghese J, Liddell R, Farrell M, Murray F, Osborne DH, Lee MJ, et al. Diagnostic accuracy of magnetic resonance cholangiopancreatography and ultrasound compared with direct cholangiography in the detection of choledocholithiasis. Clinical Radiology 2000;55(1):25-35.

14. Chen W, Mo JJ, Lin L, Li CQ, Zhang JF. Diagnostic value of magnetic resonance cholangiopancreatography in choledocholithiasis. World journal of gastroenterology: WJG. 2015 Mar 3;21(11):3351.

15. Griffin N, Wastle ML, Dunn WK, Ryder SD, Beckingham IJ. Magnetic resonance cholangiopancreatography versus endoscopic retrograde cholangiopancreatography in the diagnosis of choledocholithiasis. European journal of gastroenterology & hepatology. 2003 Jul 1;15(7):809-13.

16. Hennig J, Nauerth A, Friedburg HR. RARE imaging: a fast imaging method for clinical MR. Magnetic resonance in medicine. 1986 Dec;3(6):823-33.

17. Frey CF, Burbige EJ, Meinke WB, Pullos TG, Wong HN, Hickman DM, Belber J. Endoscopic retrograde cholangiopancreatography. The American Journal of Surgery. 1982 Jul 1;144(1):109-14.

18. de Ledinghen V, Lecesne R, Raymond JM, Gense V, Amouretti M, Drouillard J, Couzigou P, Silvain C. Diagnosis of choledocholithiasis: EUS or magnetic resonance cholangiography? A prospective controlled study. Gastrointestinal endoscopy. 1999 Jan 1;49(1):26-31.

19. Zahur Z, Jielani A, Fatima T, Ahmad A. Transabdominal ultrasound: a potentially accurate and useful tool for detection of choledocholithiasis. Journal of Ayub Medical College Abbottabad. 2019 Nov 1;31(4):572-5.

20. Javaid A, Mahmood R, Ullah H, Shafiq M, Dildar N, Abbas G. Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography in the Detection of Choledocholith, taking Post-Operative findings as the Gold Standard. Pakistan Armed Forces Medical Journal. 2023 Apr 17;73(2):394-97.

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