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Efficacy of Myofascial Release on Pain and Pulmonary Function during First Phase of Cardiac Rehabilitation - An Evidence Based Study

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ABSTRACT

Background: Cardiovascular disease includes disease of heart and blood vessels. It is most common causes of mortality around the globe as well as in India.[1],[2] Cardiac rehabilitation and secondary prevention programs aim to improve all lifestyle habits, quality of life and physical and psychological function. However, surgical procedures like coronary artery bypass grafting have some complications. They may affect different systems but most frequent Complications are pulmonary complications. As a result of Surgical trauma in highly vascularised and innervated pleura and chest wall, severe pain after sternotomy occurs. which will cause weakens the respiratory muscles, reduces chest expansion, glenohumeral joint and spine mobility, as well as lessen expectoration of secretions.

Purpose:

To provide an overview of current evidence with respect to:

1. Effect of manual therapy (OMT, MFR) in post sternotomy acute and chronic pain.
2. Immediate effect of manual therapy pulmonary system.
3. Effect of manual therapy functional recovery and length of hospital stay, reduce analgesia consumption, improve ROM.
4. Effect of MFR on pulmonary function.

Methodology:

➢ Search engines used were:

• Google scholar • PubMed • PEDro • ScienceDirect • ResearchGate

➢ Key words used were:

• Sternotomy • Post sternotomy pain • Pulmonary function • Myofascial release • OMT • Respiratory function and sternotomy

Total 10 studies were selected.

Results: Evidences were reviewed and analysis was done. Articles shows that MFR reduce post-operative pain, improve respiratory function, reduces length of stay and dose of analgesia consumption.

Conclusion: Based on evidences, it is reviewed that MFR and manual therapy is beneficial in seance of reducing pain and improving pulmonary function in post sternotomy patients.

Keywords: Sternotomy, Post sternotomy pain, Pulmonary function, Myofascial release, OMT, Respiratory function and sternotomy

Clinical Implication

• Myofascial release techniques in conventional cardiac rehabilitation may improve the pulmonary function in patients during early postoperative period. • Myofascial release techniques may decrease breathing difficulties as well as pain intensity. • Myofascial release may enhance patient's improvement during early postoperative period.

INTRODUCTION

Cardiovascular disease includes disease of heart and blood vessels. It is most common causes of mortality around the globe as well as in India.[1],[2] Cardiac rehabilitation and secondary prevention

programs aim to improve all lifestyle habits, quality of life and physical and psychological functions. The patient population for these programs have coronary artery disease, heart attack, heart failure, peripheral artery disease, angina, congenital heart disease, coronary artery bypass surgery.[3]

A median sternotomy is probably the most frequently used incision for cardiothoracic operations[4] Typical complications are related to pain, blood loss, medication effects and infections. These complications include superficial wound infection, bony non-union/sternal instability, sternal dehiscence, and mediastinitis [5].

Pain is the most common reported complication after sternotomy. Acute pain can reduce physical activity tolerance, alter normal respiration and airway clearance and prolonged hospitalization and can also decrease quality of life. Most of the pain after sternotomy occurs because of tissular damage in the skin, subcutaneous tissue, bone, and cartilage. Infect, usage of large amount of analgesic postoperatively suggests chronic pain.[5]

Thus, it is important to treat the postoperative acute pain in order to avoid transition from acute to chronic pain.[6] Post sternotomy there is significant reduction in pulmonary function test[7].

Some postural changes occur post CABG due to sternotomy. Patient will attain stoop or bent over posture. This position in some way protects against pain from a cut sternum, but it also restricts the mobility of the ribs and diaphragm and deterioration of respiration. Because the sternotomy, in the early postoperative exercises that require sideway abduction or exercises in front and side lying positions are contraindicated.[8]

Surgical incisions cause pain. Because of pain tone of thorax and abdominal wall increased, thus reduction in chest wall compliance which cause decrease lung volume which led to increase work of breathing. Increase in muscle tone in and around incision is known as muscle splinting of incision. During early stage after surgery exercises that require sideway abduction or exercises in front and side lying positions are not allowed.[8]as an example abduction of upper extremity. According to Mayers's anatomic trains concept's these structures are forming superficial front line and lateral line. However Functional training front- and lateral-line structure led to improvement of pulmonary function [9].

METHODOLOGY

Study Type: An Evidence Based Study was conducted according toPreferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA)guidelines (Figure 1).

Search strategy: The search engines used for finding out appropriate articles were: Google Scholar, PubMed, PEDro, Science Direct, ResearchGate.

Key words used for the search were:
Sternotomy • Post sternotomy pain • Pulmonary function • Myofascial release • OMT • Respiratory function and sternotomy

Eligibility criteria: Articles were selected from last 10 years [2010-2020]. 10 Articles were viewed.

Data Analysis: All 10articles were assessed using 2 scales:

1. **The PEDro scale:** It assesses methodological quality and consists of a checklist of 11 criteria, 10 of which are scored. For each criterion the study met, 1 point was awarded. The points were tallied and presented as a score out of 10. The scale applies only to experimental studies. For this review, investigations with PEDro scores of 6 to 10 were considered high quality, of 4 to 5 were considered moderate quality, and of 0 to 3 were considered low quality. The PEDro score has demonstrated 'fair' to 'excellent' inter-rater reliability (Intraclass Correlation Coefficient 0.53-0.91) for randomized controlled trials of physiotherapy interventions. Convergent

validity is supported for the PEDro score through correlation with other quality rating scales including: the Jadad scale (0.35) and van Tulder 2003 scale (0.71) for clinical trials of physiotherapy related interventions. [7] (Appendix 1)

2. **The CEBM's Levels of Evidence scale:** It assesses quality based on study design, which categorize the studies in a scale ranging from 1 to 5 with further subdivision for each. (Appendix 2)

The CEBM's Levels of Evidence scale: It assesses quality based on study design, which categorize the studies in a scale ranging from 1 to 5

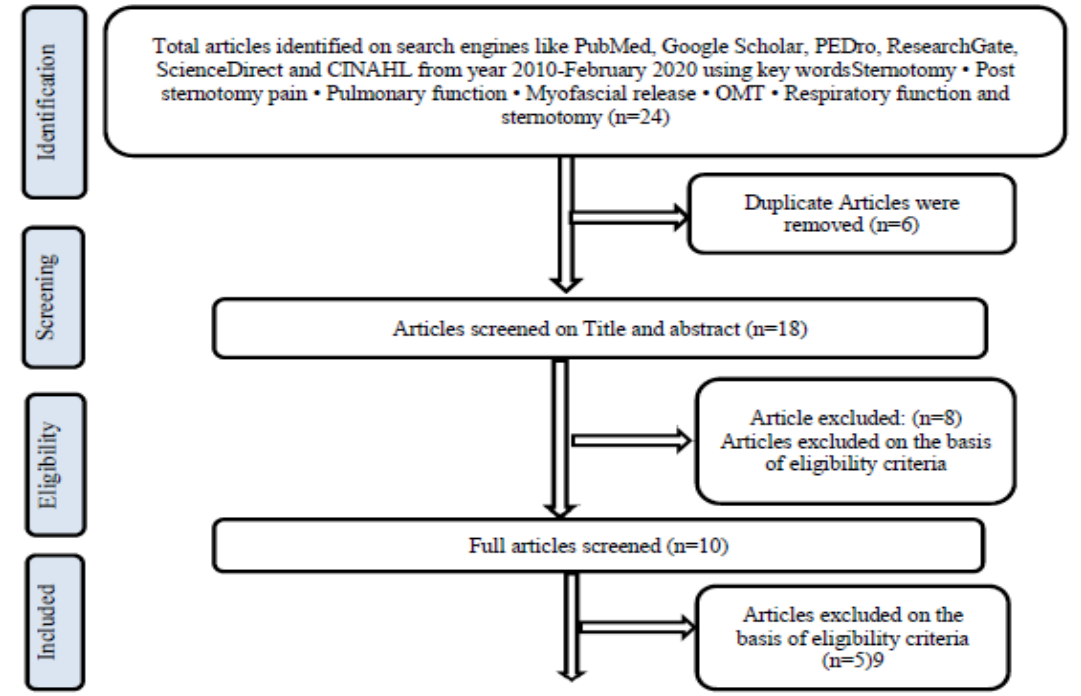
APPENDIX 1-PEDro SCALE

No.	Description	Yes / No
1	Eligibility criteria were specified (No points awarded)	
2	Subjects were randomly allocated to groups	
3	Allocation was concealed	
4	The groups were similar at baseline regarding the most important prognostic indicators	
5	There was blinding of all subjects	
6	There was blinding of all therapists who administered the therapy	
7	There was blinding of all assessors who measured at least one key outcome	
8	Measure of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	
9	All subjects for whom outcome measures were available received the treatment or control condition as allocated	
10	The result of between group comparisons are reported for at least one key outcome	
11	The study provides both point measures and measures of variability for at least one key outcome	

APPENDIX 2- CEBM'S LEVEL OF EVIDENCE

Level	Definition
1a	Systematic reviews of randomized controlled trials
1b	Individual randomized controlled trials
1c	All-or-none studies
2a	Systematic reviews of cohort studies
2b	Individual cohort studies or low-quality randomized controlled trials
2c	Outcome research
3a	Systematic reviews of case-control studies
3b	Individual case-control studies
4	Case series, poorly designed cohort or case-control studies
5	Animal and bench research, expert opinion

Figure 1: Preferred Reporting Items for systematic reviews and meta-analysis (PRISMA)



r. no.	Article	Study design	Sample size	Treatment Duration	Outcome Measures	Level of evidence & Pedro	Findings
1	Myofascial release in patients during the early postoperative period after revascularisation of coronary arteries.[20]	RCT	80	UP TO DISCHRAGE	VAS, The borg scale, $FEV_{1\ \&}$FVC	1b Score=9	MFR improves pulmonary function, reduce breathing in difficulties, painseverity and fatigue as well as enhance physical endurance.
2	Osteopathic treatment leads to significantly greater reductions in chronic thoracic pain after CABG surgery: A randomised controlled trial [21]	RCT	82	12 weeks	SVC, McNew QoL, VAS, $VO_{2\ max,}$ Thoracic stiffness.	1b Score=8	OT shows greater reductions in thoracic pain after CABG surgery
3	Hemodynamic effects of osteopathic manipulative treatment immediately after coronary artery bypass graft surgery.[22]	Pilot prospective clinical trial	29	Onetime study	S_vO_2 CI TI	2b	Reduction in (1) pulmonary complications (such as atelectasis and pneumonia); (2) days of hospitalization (3) risk of fluid imbalances
4	The Effect of Osteopathic Manipulative Treatment on Postoperative Medical and Functional Recovery of Coronary Artery Bypass Graft Patients [23]	RCT	53		FIM, Discharge to home days, Time to Bowel Movement, days.	1b Score=8	Functional capacity can be improved by daily implication of OMT postoperatively.
5	Osteopathic Manipulative Treatment in Surgical Care: Short Review of Research Publications in Osteopathic Journals During the Period 1990 to 2017[24]	Summary review	10 articles		Pain, analgesia consumption, Length of hospital stay, and Range of motion	-	Concluded that there is an urgent need to evaluate OMT.
6	Osteopathic Manipulative Treatment Improves Heart Surgery Outcomes: A Randomized Controlled Trial [25]	RCT	80		VAS 6MWT, HOSPITAL ANXIETY AND DEPRESSION SCALE, INSPIRATORY VOLUME	1b Score=7	The combination of standard care with OMT is effective to reduce pain and improve functional recovery.
7	The immediate effect of soft tissue manual therapy [STMTP]intervention on lung function in severe chronic obstructive pulmonary disease.[26]	RCT	12	One time study	RV, IC, SpO_2	2b Score=5	STMTP application have the potential to produce immediate clinically improvements in pulmonary function in patients with severe and very severe COPD.
8	The effect of osteopathic manipulative treatment on length of stay in posterolateral post thoracotomy patients: A retrospective case note study [27]	RCT	38		LOS, ICU utilization	4	There was no difference in LOS, severity of illness was different between patients who received OMT and those who did not.
9	The effect of postoperative ataralgesia by manual therapy after pulmonary Resection [28]	-	8		VAS	2	Manual therapy stimulates the secretion of pain suppressingsubstances, thus alleviates pain. It improves the local circulation reduces muscle spasm, and helps to normalize muscle properties.
10	The Impact of Myofascial Release on Vital Capacity and Diaphragmatic Excursion in Postsurgical Pleural Effusion [29]	-	40	8 Weeks	FVC, DIAPHRAGMITC EXCURSION BY USG	2	MFR for diaphragm and intercostal muscles shows positive impact on vital capacity and diaphragmatic excursion in postsurgical pleural effusion.

DISCUSSION

Total 10 studies were reviewed from various data sources and included in this evidenced based research; the methodological qualities of included studies were low to high. Sample size varied from 8 to 82.

In randomized control trial, Maria Ratajska et al found that post sternotomy MFR lessens pain severity. The authors also found lessen fatigue and improvement of physical endurance. while other two randomized control trials studied the effect of OMT following heart surgery and concluded that Osteopathic manual therapy (OMT) is effective in reduction of pain, additionally better functional recovery is achieved by OMT.

A study done by F. Hirayama et al studied effect of postoperative ataralgesia following pulmonary resection and found that manual therapy cause pain relief, improves local circulation reduce muscle spasm and helps to normalize properties .[20],[21],[28],[25] Another randomized control trial and a pilot study data suggest that following OMT & manual therapy there is immediate enhancement in venous oxygen saturation (SVO2), Cardiac index (CI), Thoracic impedance (TI),Residual volume (RV), Inspiratory capacity (IC),Oxygen saturation (SPO2). [22],[26] J Michael Wieting and colleagues examined effect of OMT on functional recovery and showed that post-operative OMT protocol improves functional capacity.

One retrospective case study investigated that there are no difference days of hospitalization following OMT in posterolateral post thoracotomy patients as severity of illness was greater for those who received OMT. [23],[25],[26] More recently, there has been research investigating the effect of MFR on pulmonary function following CABG and pleural effusions, it has been shown that myofascial release improves lung function. [29],[20]

One summative review investigated effect of OMT in various surgical care and concluded that the OMT reduces pain, use of analgesia and length of hospitalization and improves mobility.

CONCLUSION

Based on evidences on following search engines like PEDro, Google scholar, PubMed, Research gate, ScienceDirect and the Cochrane library from the year 2011-2020, it can be concluded MFR following sternotomy may be effective in improving pulmonary function and reduction of pain in first phase of cardiac rehabilitation.

ABBREVIATIONS: CVD-Cardiovascular disease CR-Cardiac rehabilitation MFR-Myofascial release OMT-Osteopathic manual therapy CABG-coronary artery bypass grafting ROM-Range of motion SIS -Sternal instability scale AHA-American Herat Association AACVPR-American Association of Cardiovascular and Pulmonary Rehabilitation SCM-Sternocleidomastoid Muscle TFL-Tensor fascial lata IC-Intercostal CEBM's-Centre for Evidence-Based Medicine's PEDro-Physiotherapy evidence data base RCT-Randomise control trials VAS-Visual analogue scale FEV1-Forced vital capacity in one second XIII FVC-Forced vital capacity OT-Osteopathic treatments SCV-Slow vital capacity QLQ-Quality of life SvO2-Venous oxygen saturation HRV-Heart valve replacement LIMA-Left internal mammary artery IHD-Ischemic heart disease STMTP-Soft tissue manual therapy intervention TI-Thoracic impedance CI-Cardiac index IV-Inspiratory volume IC-Inspiratory capacity LOS-Length of stay RV-Residual volume

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Conflict of Interest: None

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Ethical Approval: Ethical approval was not required

REFERENCES

1. JE, Lim M, DesMeules M, Luo W, Burke N, O'Reilly D, Bowen J, Goeree R. A

review of the cost of cardiovascular disease. Can J Cardiol. 2009 Jun;25(6): e195- 202.
2. Madan, Kushal & Babu, Abraham & Contractor, Ashish & Sawhney, J.P.s & Dorairaj, Prabhakaran & Gupta, Rajeev. (2014). Cardiac Rehabilitation in India. Progress in Cardiovascular Diseases. 56. 543-550. 10.1016/j.pcad.2013.11.001.
3. Servey, Jessica & Stephens, Mark. (2016). Cardiac Rehabilitation: Improving Function and Reducing Risk. American family physician. 94. 37-43.
4. Thompson, David. (2021). Systematic review finds no difference between home-based and centre-based cardiac rehabilitation in terms of effect on mortality, morbidity and modifiable risk factors in patients with CHD (Commentary on: Dalal HM, Zawada A, Jolly K, et al. Home-based ver.
5. Burnfield, Judith & Cesar, Guilherme & norkin, cynthia. (2019). Examination of Gait. Editors: Susan B. O'Sullivan, Thomas J. Schmitz, George D. Fulk. In: Physical Rehabilitation, Seventh Edition.
6. Rehabilitation, American. (2021). Guidelines for cardiac rehabilitation programs/American Association of Cardiovascular and Pulmonary Rehabilitation. Serbiula (sistema Librum 2.0).
7. Balady GJ, Williams MA, Ades PA, Bittner V, Comoss P, Foody JM, Franklin B, Sanderson B, Southard D; American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; American Heart Association Council on Cardiovascular Nursing; American Heart Association Council on Epidemiology and Prevention; American Heart Association Council on Nutrition, Physical Activity, and Metabolism; American Association of Cardiovascular and Pulmonary50 Rehabilitation. Circulation. 2007 May 22;115(20):2675-82. doi:10.1161/ circulationaha. 106.180945. Epub 2007 May 18. PMID: 17513578.
8. Reser, Diana & Caliskan, Etem & Tolboom, Herman & Guidotti, Andrea & Maisano, Francesco. (2015). Median sternotomy. Multimedia manual of cardiothoracic surgery: MMCTS/ European Association for Cardio-Thoracic Surgery. 2015. 10.1093/ mmcts/ mmv017.
9. Bailey and love's short practice of surgery (25th edition).
10. Roxas, Mario. (2005). Plantar fasciitis: Diagnosis and therapeutic considerations. Alternative medicine review: a journal of clinical therapeutic. 10. 83-93.
11. The myofascial release manual 3rd edition Carol J. Manheim, MS/ MEd, PT, LPC Center Charleston, SC
12. Tessler J, Bordoni B. Cardiac Rehabilitation. [Updated 2020 Jun 2]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from:
13. El-Ansary, Doa & LaPier, Tanya & Adams, Jenny & Gach, Richard & Triano, Susan & Ali, Katijjahbe & Hirschhorn, Andrew & Mungovan, Sean & Lotshaw, Ana & Cahalin, Lawrence. (2019). An Evidence-Based Perspective on Movement and Activity Following Median Sternotomy. Physical therapy. 99. 10.1093/ptj/pzz126.
14. Ellen hillegass Essential of cardiopulmonary physical therapy 4th edition.
15. Huang, Ana & Sakata, Rioko. (2016). Pain after sternotomy-review. Brazilian journal of Anesthesiology (English Edition). 66. 10.1016/j.bjane.2014.09.013.
16. Luleci, Nurettin & Dere, Kamer & Akbaş, Mert & Aldulkerimov, Vugar & Lüleci, Emel & Guler, Mustafa. (2008). Myofascial pain at post-sternotomy patients after cardiac surgery: A 51 clinical study in 1226 patients. Journal of Back and Musculoskeletal Rehabilitation. 21. 239-243. 10.3233/BMR-2008-21404.
17. Chetta, Alfredo & Bobbio, Antonio & Marina, Aiello & Del Donno, Mario & Castagnaro, Antonio & Comel, Andrea & Malorgio, Roberto & Carbognani, Paolo & Rusca, Michele & Olivieri, Dario. (2006). Changes in Lung Function and Respiratory Muscle Strength after Sternotomy vs. Laparotomy in Patients without Ventilatory Limitation. European surgical research. Europäische chirurgische Forschung. Recherches chirurgicales européennes. 38. 489-93. 10.1159/000096008.
18. Ratajska M, Chochowska M. Rozluznianie mieRsniowo-powieziowe wg Carol Manheim-jako innowacyjne uzupełnienie fizjoterapii w pierwszym okresie po rewaskularyzacji tetnic wiencowych [Carol Manheim's myofascial release techniques - a innvative complementary physiotherapy in

first stage after coronary artery revascularisation]. Hyg Publ Heal. 2013;48 (4):400-407. [Polish].
19. M S, Ajimsha & Al-Mudahka, Noora & Al-Madzhar, J.A.. (2014). Effectiveness of myofascial release: Systematic review of randomized controlled trials. Journal of Bodywork and Movement Therapies. 19. 10.1016/j.jbmt.2014.06.001.
20. Ratajska, Maria & Chochowska, Małgorzata & Kulik, Anita & Bugajski, Paweł. (2019). Myofascial release in patients during the early postoperative period after revascularisation of coronary arteries. Disability and Rehabilitation. 10.1080/ 09638288.2019. 1593518. Manual Therapy, Volume 8, Issue 1,2003,Pages 42-45,ISSN 1356-689X,
21. Roncada G. Osteopathic treatment leads to significantly greater reductions in chronic thoracic pain after CABG surgery: A randomised controlled trial. J Bodyw Mov Ther. 2020 Jul;24(3):202- 211. doi: 10.1016/j.jbmt.2020.03.004. Epub 2020 Mar 17. PMID: 32825989.
22. O-Yurvati AH, Carnes MS, Clearfield MB, Stoll ST, McConathy WJ. Hemodynamic effects of osteopathic manipulative treatment immediately after coronary artery bypass graft surgery. J Am Osteopath Assoc. 2005 Oct;105(10):475-81. PMID: 16314680.
23. Wieting JM, Beal C, Roth GL, Gorbis S, Dillard L, Gilliland D, Rowan J. The effect of osteopathic manipulative treatment on postoperative medical and functional recovery of coronary artery bypass graft patients. J Am Osteopath Assoc. 2013 May;113(5):384-93. PMID: 23667192.
24. altazar GA, Betler MP, Akella K, et al. Effect of osteopathic manipulative treatment on incidence of postoperative ileus and hospital length of stay in general surgical patients. The Journal of the American Osteopathic Association. 2013 Mar;113(3): 204-209
25. Racca V, Bordoni B, Castiglioni P, Modica M, Ferratini M. Osteopathic Manipulative Treatment Improves Heart Surgery Outcomes: A Randomized Controlled Trial. Ann Thorac Surg. 2017 Jul;104(1):145-152. doi: 10.1016/ j.athoracsur.2016.09.110. Epub 2017 Jan 18. PMID: 28109570.
26. Cruz-Montecinos C, Godoy-Olave D, Contreras-Briceño FA, Gutiérrez P, Torres-Castro R, Miret-Venegas L, Engel RM. The immediate effect of soft tissue manual therapy intervention on lung function in severe chronic obstructive pulmonary disease. Int J Chron Obstruct Pulmon Dis. 2017 Feb 21; 12:691-696. doi: 10.2147/ COPD.S127742. PMID: 28260875; PMCID: PMC5327901
27. Regina K. Fleming, Karen T. Snider, Kent J. Blanke, Jane C. Johnson,The effect of osteopathic manipulative treatment on length of stay in posterolateral post thoracotomy patients: A retrospective case note study, International Journal of Osteopathic Medicine, Volume 18, Issue 2,2015, Pages 88-96,ISSN 1746-0689,
28. Hirayama, F & Kageyama, Y & Urabe, N & Hideaki, Senjyu. (2003). The effect of postoperative ataralgesia by manual therapy after pulmonary resection. Manual therapy. 8. 42-5. 10.1054/math.2002.0473.
29. Ph.D., MOHAMED & M.D., AWNY. (2018). The Impact of Myofascial Release on Vital Capacity and Diaphragmatic Excursion in Postsurgical Pleural Effusion. The Medical Journal of Cairo University. 86. 4153-4158. 10.21608/mjcu.2018.62797

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