

How to Cite:

Chou, T. S., Janugade, H. B., & Katkar, A. (2022). Comparative study between mayo's repair and retro-rectus mesh repair in umbilical and para-umbilical hernias. *International Journal of Health Sciences*, 6(S2), 3008–3017. <https://doi.org/10.53730/ijhs.v6nS2.5724>

Comparative study between mayo's repair and retro-rectus mesh repair in umbilical and para-umbilical hernias

Teh Shin Chou

Professor, Department of Surgery, Krishna Institute of Medical Sciences Deemed To Be University, Karad, Maharashtra (India)

H. B. Janugade

Resident, Department of Surgery, Krishna Institute of Medical Sciences Deemed To Be University, Karad, Maharashtra (India)

Akash Katkar

Assistant Professor, Department of Surgery, Krishna Institute of Medical Sciences Deemed To Be University, Karad, Maharashtra (India)

Abstract---To assess if Mayo's repair can be used with an equal efficacy as Retro-rectus Mesh Repair in cases of uncomplicated Umbilical and Paraumbilical hernias. Method: A Prospective Comparative study was conducted from December 2019 to June 2021 at Department of Surgery OPD, Krishna Hospital, Karad. A total of 120 subjects with uncomplicated Umbilical and Paraumbilical hernia were enrolled in this study and were randomly allocated to Group A and Group B. In Group A umbilical hernia repair was done using Mayo's repair whereas in Group B subjects underwent Retro-rectus Mesh repair. Results: The 120 subjects were divided into two groups of 60(50%) each. We observed that majority of the study subjects were females (85% and 86.67% in either groups). The M:F ratio in the current study was 1:5.6 in first group and 1:6.5 in second group. We observed that majority of the study subjects were overweight (40% & 43.33% in either group). We observed that diabetes was present among 28.33% and 10% subjects in either group, whereas hypertension was reported among 16.67% and 5% subjects in either groups. COPD was observed among 1.67% and 10% study subjects respectively. Tuberculosis was reported among 6.67% study subjects in mesh group. BPH was noted among 1.67% subjects in mesh group. All diabetic patients were included in the Mayo's repair group. Only those diabetic patients with defect size more than 6 cm were included in the mesh group, whereas all the patients with COPD and asthma were included in the mesh group. We observed that majority of the study

subjects presented with para-umbilical hernia (93.33% and 95% in either group). Whereas 6.67% & 5% subjects presented with umbilical hernia in the study groups respectively. We observed that in Mayo's repair group, majority of the study subjects had defect size less than 6 cm [4 to 6 cm among 45%, and 2 to 4 cm among 35% study subjects], whereas in mesh repair group, majority of the subjects had defect size more than 6 cm (91.67%). In this study we compared the comorbidities and occurrence of complications in post operative follow up. In Mayo's repair group, out of cases who developed wound infection, 33.33% were diabetics, while in mesh repair group, out of total 4 cases who developed infection, 75% were diabetics, 25% had COPD / asthma. Similarly, all the cases in mesh repair group who developed seroma were diabetics. Conclusion: Prosthetic mesh repair is a technique with good postoperative outcome, low recurrent rate and excellent patient satisfaction but has a greater long term potential for complication specially in diabetic patients, as mesh is a foreign object. Mayo's repair technique can be used with same efficacy as retro-rectus Mesh Repair in patient's with defect size less than 6cm.

Keywords---comparative study, umbilical, para-umbilical hernias.

Introduction

Umbilical hernia is defined as a midline hernia that occurs through the linea alba abutting superiorly or inferiorly on the umbilicus, and in adults it is more accurately described as Para-umbilical hernia, because the defect occurs through the decussating fibers of linea alba rather than the original umbilical scar. Umbilical hernia repair is one of the most popular general surgical operations. Prior to the development of the laparoscopic procedure, onlay mesh installation was one of the most prevalent methods of treating this hernia. However, morbidity and recurrence following either of these repairs became rather prevalent, emphasizing the importance of developing a safe and strong repair procedure.¹⁻⁴

Para-umbilical hernia is a midline hernia that occurs through the linea Alba and abuts the umbilicus superiorly or inferiorly. One of the most common hernias in adults is a paraumbilical hernia. Paraumbilical hernias are formed through a multifactorial and complex process and are most typically encountered along the midline linea Alba. Despite the fact that they are frequently supraumbilical in position. Paraumbilical hernias are relatively prevalent in the adult population, with females outnumbering males by a factor of three and a half to one. Multiparous status, obesity, older age, emphysema, asthma and other chronic lung disorders, prostatism, abdominal distention, steroid use, coughing, and lifting weight are all factors that contribute to an increase in abdominal pressure in 90% of patients. Paraumbilical hernia is frequently asymptomatic or causes sporadic symptoms. The most common initial symptom is discomfort or a ventral bulge, and the most common content is omentum, but bowel blockage can also be the first symptom that leads a patient to seek medical assistance. If the hernia neck defect is tiny, incarceration and strangulation are more likely.⁶⁻⁹

Mayo's repair was previously used to repair paraumbilical hernias, but it has a high recurrence rate of up to 28% to 30%. As a result, Mesh repair has been adopted as the standard treatment for paraumbilical hernia repair; it has a lower recurrence rate than Mayo's repair. Although umbilical hernias are among the most frequent abdominal wall defects, little research has been conducted to track their prevalence. According to Western studies, the overall incidence of hernias is 4.65 percent. One of the most prevalent surgical difficulties is the care of paraumbilical hernias. A variety of surgeries are being used to treat paraumbilical hernia.¹⁰ In this study an attempt is made to investigate whether Mayo's repair can be used with an equal efficacy rate as a Retro-rectus mesh repair in patients admitted from December 2019 to June 2021, at Krishna Hospital and Medical Research Centre, Karad.

Methods

This is a prospective comparative study conducted from December 2019 to June 2021 in the Department of Surgery at Krishna Hospital. All the materials for this study was taken from 120 patients who were admitted at Krishna Hospital after taking informed written consent and being explained about the procedure and its results.

The study criteria include randomly patients with uncomplicated Umbilical or Para-umbilical hernia coming to the Krishna Hospital from December 2019 to June 2021. Patients presenting with Umbilical or Para-Umbilical hernia with multiple comorbidities viz uncontrolled diabetes, alcoholic liver disease, ascites, strangulated umbilical/ paraumbilical hernias, recurrent umbilical/ paraumbilical hernias were excluded from the current study.

A detailed history was recorded on a specially prepared, pre-validated, semi-structured, standard case record proforma. A thorough physical examination including abdominal and rectal examination was done in every patient. Cardiovascular, respiratory and central nervous system were examined for evidence of any concomitant disease. The relevant investigations like complete blood count, blood urea, blood sugar, urine RE and X-ray chest were performed for preoperative evaluation and fitness for general anesthesia. Patients were randomly assigned using closed envelope technique to either the mesh repair group (group-1, 60 cases) or Mayo's repair group (group-2, 60 cases). (As suggested by N A Henriksen et al in their Guidelines for treatment of umbilical and epigastric hernias from the European Hernia Society and Americas Hernia Society, among the patients with preventable comorbidities such as diabetes and immunosuppression, wound related complications are more likely to occur. Hence in the present study diabetic study subjects were preferred to be managed with Mayo's repair). Operative time, length of postoperative hospital stay, and postoperative complications was recorded. Follow-up in the outpatient clinic by physical examination on a weekly basis for the first six postoperative weeks and then on three monthly basis thereafter, to detect recurrence. Recurrence was defined as "the presence of a defect on the central part of the midline aponeurosis where the operation had been performed".

Mayo's Repair Procedure

After anaesthesia patient is laid on supine position, parts painted, and drapes are applied to allow access to the umbilical area. A transverse elliptical incision is made enclosing the umbilicus and the skin covering the hernia. It should extend laterally on each side for at least 5cm beyond the protuberance. It is deepened through subcutaneous fat until the glistening surface of the aponeurosis is exposed. The neck of the sac is generally free from adhesions and is opened first. Before doing so, the aponeurosis is cleared centrally from all directions, until the neck of the hernia is exposed of the level where it emerges through linea Alba. A small incision is made in the fibrous coverings of the neck of any convenient point on its circumference and is carefully deepened until the sac itself has been opened. A finger is introduced and is passed round the inside of the sac to determine the presence of any adhesions. The remaining circumference of the neck of the sac is then divided with scissors, the finger being used to protect the contents from injury. The central island comprising the sac together with attached ellipse of skin and fat is now joined to the abdomen only by contents is carefully examined. If they consist of omentum, which is ischaemic, it can be ligated and excised, if it is healthy, it can be reduced into peritoneal cavity. If bowel is the content, sac is opened up as far as possible. The sac is now gradually turned inside out, and contents gently peeled off its interior. Adherent omentum removed along with the sac. Adhesions between adjacent coils of intestine are released as far as possible and the hernial contents are returned to the abdominal cavity. The peritoneum is closed with an absorbable running suture, flaps of fascia are raised off the peritoneum and overlapped with a 3cm overlap. The flaps are closed with a monofilament non-absorbable sutures using double breasting technique.



Image: Mayo's repair

Mesh Repair Procedure

In the prosthetic mesh repair group, the operative field was first soaked with povidone iodine for 10 min. Next, skin and subcutaneous flaps were elevated to fit a 15cm x 7.6 cm monofilament polypropylene mesh (Prolene, Ethicon). The mesh was then fixed to the abdominal wall muscles as retrorectal patch, (between the posterior rectus sheath and rectus abdominis muscle) using interrupted non-absorbable sutures Prolene 2/0, Ethicon). The center of the mesh was overlaid on the closed abdominal wall defect. In both groups 16 Fr Romovac suction drain was inserted subcutaneously and was removed when its daily effluent was <50ml per 24 h for two consecutive days.

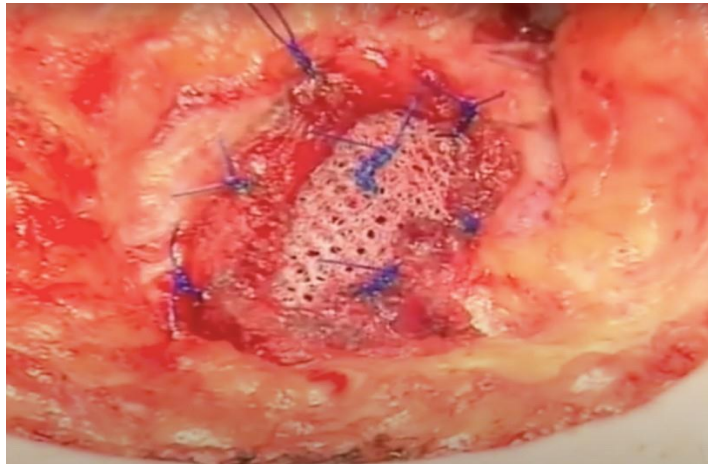


Image: Mesh repair

Results

In the present study we observed that majority of the study subjects were females (85% and 86.67% in either groups). The M:F ratio in the current study was 1:5.6 in first group and 1:6.5 in second group. We assessed the Age distribution among the study subjects and observed that majority of the study subjects belonged to the age group of 36 to 50 years (35% and 36.67% in either study groups.). The mean age of the study subjects was 41.28 ± 18.60 years (Median age 47 years) in Mayo's repair group and 39.28 ± 16.86 years (median age 42 years) in mesh repair group. In the present study we assessed the Body mass index among the study subjects. We observed that majority of the study subjects were overweight (40% & 43.33% in either group), followed by 20% & 11.67% subjects in either group who were obese. 26.67% and 23.33% subjects in both groups respectively had normal weight.

In the present study we assessed the comorbidities among the study subjects. We observed that diabetes was present among 28.33% and 10% subjects in either group, whereas hypertension was reported among 16.67% and 5% subjects in either groups. COPD was observed among 1.67% and 10% study subjects respectively. Tuberculosis was reported among 6.67% study subjects in mesh group. BPH was noted among 1.67% subjects in mesh group.

In the present study we assessed the clinical presentation among the study subjects. We observed that swelling (95% and 91.67%) which was reducible (91.67% and 86.67%) and associated with cough impulse (95% and 96.67%) was the commonest complaint. Followed by pain (43.33% and 51.67% in either groups). Skin changes were noted in 11.67% and 8.33% subjects in either groups. In the present study we assessed the Types of hernia among the study subjects. We observed that majority of the study subjects presented with para umbilical hernia (93.33% and 95% in either group). Whereas 6.67% & 5% subjects presented with umbilical hernia in the study groups respectively.

In the present study we assessed the Hospital stay among the study subjects. We observed that the mean hospital stay duration in Mayo's repair was 3.03 ± 1.36 days, and among Mesh repair group was 3.56 ± 1.11 days. Median hospital stay was 3 days and 3 days in either study groups. In the present study we assessed the Defect size among the study subjects. We observed that in Mayo's repair group, majority of the study subjects had defect size less than 6 cm [4 to 6 cm among 45%, and 2 to 4 cm among 35% study subjects], whereas in mesh repair group, majority of the subjects had defect size more than 6 cm (91.67%).

Table 1: Size of Defect

Defect size	Mayo's repair		Mesh repair	
	Number of subjects	Percentage	Number of subjects	Percentage
Less than 2 cm	8	13.33	0	0.00
2 to 4 cm	21	35.00	1	1.67
4 to 6 cm	27	45.00	4	6.67
More than 6 cm	4	6.67	55	91.67
Total	60	100.00	60	100.00

In the present study we assessed the Complications among the study subjects. We observed that wound infection was reported among 5% subjects in Mayo's repair, and 6.67% subjects with Mesh repair. Seroma was reported among 1.67% subjects with Mayo's repair, and 3.33% study subjects with Mesh repair. The complication rate is considerable, however, since the mesh is in the retro-rectus plane. Seromas and surgery site infections are also prevalent. This increases the risk of mesh infection and hernia recurrence. The presence of a mesh in the subcutaneous tissues causes a foreign body sensation. The mesh has also been described as migrating, which leads to recurrence.

Table 2: Complication of the Procedure

Complications	Mayo's repair		Mesh repair	
	Number of subjects	Percentage	Number of subjects	Percentage
Wound infection	3	5.00	4	6.67
Seroma	1	1.67	2	3.33

Recurrence	0	0.00	0	0.00
------------	---	------	---	------

In this study we compared the comorbidities and occurrence of complications in post operative follow up. In Mayo's repair group, out of cases who developed wound infection, 33.33% were diabetics, while in mesh repair group, out of total 4 cases who developed infection, 75% were diabetics, 25% had COPD / asthma. Similarly, all the cases in mesh repairgroup who developed seroma were diabetics.

Table 3: Comorbidities compared with complications

Comorbidities with complications	Mayo's repair		Mesh repair	
	Wound infection	Seroma	Wound infection	Seroma
Diabetes Mellitus	1 (33.33%)	0	3 (75%)	2 (100%)
Hypertension	1 (33.33%)	0	0	0
COPD / Asthma	1 (33.33%)	0	1 (25%)	0
Tuberculosis	0	0	0	0
BPH	0	1 (100%)	0	0
Total	3 (100%)	1 (100%)	4 (100%)	2 (100%)

Discussions

Umbilical and Para-umbilical hernia (PUH) results through as a defect, it is a common surgical problem consisting of 10% of all primary hernia. They are more common in parous, obese, middle aged and elderly women. Obesity and multiparity are important predisposing factors not only for primary, but also for recurrent cases. The present study was conducted to assess if Mayo's repair can be used with an equal efficacy as Retro-rectus Mesh Repair for patients with uncomplicated umbilical/ paraumbilical hernias at a tertiary healthcare center.

In the present study we assessed the Age distribution among the study subjects. We observed that majority of the study subjects belonged to the age group of 36 to 50 years (35% and 36.67% in either study groups.), the mean age of the study subjects was 41.28 ± 18.60 years (Median age 47 years) in Mayo's repair group and 39.28 ± 16.86 years (median age 42 years) in mesh repair group. Majority of the study subjects were overweight (40% & 43.33% in either group), followed by 20% & 11.67% subjects in either group who were obese. Majority of the study subjects presented with para umbilical hernia (93.33% and 95% in either group). Whereas 6.67% & 5% subjects presented with umbilical hernia in the study groups respectively.

All diabetic patients were included in the Mayo's repair group. Only those diabetic patients with defect size more than 6 cm were included in the mesh group, whereas all the patients with COPD and asthma were included in the mesh group. When studied their clinical presentation, we observed that swelling (95% and 91.67%) which was reducible (91.67% and 86.67%) and associated with cough impulse (95% and 96.67%) was the commonest complaint. Followed by pain

(43.33% and 51.67% in either groups). Skin changes were noted in 11.67% and 8.33% subjects in either groups.

All subjects with defect size greater than 6 cm were included in mesh group, whereas with defect size less than 6 cm were included in the Mayo's repair group. Mean hospital stay among the study subjects were observed to be 3.03 ± 1.36 days in Mayo's repair, and 3.56 ± 1.11 days among Mesh repair group. Median hospital stay was 3 days and 3 days in either study groups. Complications among the study subjects were assessed and it was observed that wound infection was reported among 5% subjects in Mayo's repair, and 6.67% subjects with Mesh repair. Seroma was reported among 1.67% subjects with Mayo's repair, and 3.33% study subjects with Mesh repair. In the current study we did not reported any case of recurrence in any study group.

Conclusion

Prosthetic mesh repair is a technique with good postoperative outcome, low recurrent rate and excellent patient satisfaction but has a greater long term potential for complication specially in diabetic patients, as mesh is a foreign object. Mayo's repair technique can be used with same efficacy as retro-rectus Mesh Repair inpatient's with defect size less than 6cm.

References

1. Muysoms FE, Miserez M, Berrevoet F, Campanelli G, Champault GG, Chelala E, Dietz UA, Eker HH, El Nakadi I, Hauters P, Hidalgo Pascual M, Hoferlin A, Klinge U, Montgomery A, Simmermacher RK, Simons MP, Smietański M, Sommeling C, Tollens T, Vierendeels T, Kingsnorth A. Classification of primary and incisional abdominal wall hernias. *Hernia*. 2009 Aug;13(4):407-14.
2. Dabbas N, Adams K, Pearson K, Royle G. Frequency of abdominal wall hernias: is classical teaching out of date? *JRSM Short Rep*. 2011 Jan 19;2(1):5.
3. Shankar DA, Itani KMF, O'Brien WJ, Sanchez VM. Factors Associated With Long-term Outcomes of Umbilical Hernia Repair. *JAMA Surg*. 2017 May 01;152(5):461-466.
4. Venclauskas L, Jokubauskas M, Zilinskas J, Zvinienė K, Kiudelis M. Long-term follow-up results of umbilical hernia repair. *Wideochir Inne Tech Maloinwazyjne*. 2017 Dec;12(4):350-356.
5. Seker G, Kulacoglu H, Öztuna D, Topgül K, Akyol C, Çakmak A, et al. Changes in the frequencies of abdominal wall hernias and the preferences for their repair: a multicenter national study from Turkey. *Int Surg*. 2014;99(5):534-42.
6. Dabbas N, Adams K, Pearson K, Royle G. *JRSM Short Rep*. 1. Vol. 2. London, England: SAGE Publications Sage UK; 2011. Frequency of abdominal wall hernias: is classical teaching out of date? p. 5.
7. Kulaçoğlu H. Current options in umbilical hernia repair in adult patients. *Ulus cerrahi Derg. Turkish Surgical Association*. 2015;31(3):157-61.
8. Gray SH, Hawn MT, Itani KMF. Surgical progress in inguinal and ventral incisional herniarepair. *Surg Clin North Am*. 2008;88(1):17-26.

9. Jin J, Rosen MJ. Laparoscopic versus open ventral hernia repair. *Surg Clin North Am.* 2008;88(5):1083–100
10. Kulaçoğlu H. Current options in umbilical hernia repair in adult patients. *Ulus Cerrahi Derg.* 2015;31(3):157-161. Published 2015 Sep 1.
11. Seeras K, Qasawa RN, Ju R, et al. Anatomy, Abdomen and Pelvis, Anterolateral Abdominal Wall. [Updated 2021 Jul 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-.
12. Stumpf M, Conze J, Prescher A, Junge K, Krones CJ, Klinge U, Schumpelick V. The lateral incisional hernia: anatomical considerations for a standardized retromuscular sublay repair. *Hernia.* 2009 Jun;13(3):293-7.
13. Cho JE, Helm MC, Helm JH, Mier N, Kastenmeier AS, Gould JC, Goldblatt MI. Retro- rectus placement of bio-absorbable mesh improves patient outcomes. *Surg Endosc.* 2019 Aug;33(8):2629-2634.
14. Petro CC, Haskins IN, Perez AJ, Tastaldi L, Strong AT, Ilie RN, Tu C, Krpata DM, PrabhuAS, Eghtesad B, Rosen MJ. Hernia repair in patients with chronic liver disease - A 15- year single-center experience. *Am J Surg.* 2019 Jan;217(1):59-65.
15. Schlosser KA, Arnold MR, Otero J, Prasad T, Lincourt A, Colavita PD, Kercher KW, Heniford BT, Augenstein VA. Deciding on Optimal Approach for Ventral Hernia Repair:Laparoscopic or Open. *J Am Coll Surg.* 2019 Jan;228(1):54-65.
16. Berrevoet F. Prevention of Incisional Hernias after Open Abdomen Treatment. *Front Surg.* 2018;5:11
17. Aquina CT, Fleming FJ, Becerra AZ, Xu Z, Hensley BJ, Noyes K, Monson JRT, Jusko TA. Explaining variation in ventral and inguinal hernia repair outcomes: A population- based analysis. *Surgery.* 2017 Sep;162(3):628-639.
18. Holihan JL, Alawadi ZM, Harris JW, Harvin J, Shah SK, Goodenough CJ, Kao LS, LiangMK, Roth JS, Walker PA, Ko TC. Ventral hernia: Patient selection, treatment, and management. *Curr Probl Surg.* 2016 Jul;53(7):307-54.
19. Dubay DA, Franz MG. Acute wound healing: the biology of acute wound failure. *Surgical Clinics of North America.* 2003 June;83(3):463–81.
20. Robson MC, Hill DP, Woodske ME, Steed DL. Wound healing trajectories as predictors of effectiveness of therapeutic agents. *Arch Surg.* 2000;135:773–7
21. Santora TA, Roslyn JJ. Incisional hernia. *Surgical Clinics of North America.* 1993 June;73(3):557–70.
22. Pollock AV, Evans M. Early prediction of late incisional hernias. *British Journal of Surgery.* 1989;76:953–4
23. Carlson MA. Acute wound failure. *Surgical Clinics of North America.* 1997 June;77(3):607–36.
24. Robson MC, Steed DL, Franz MG. Wound healing: biologic features and approaches to maximize healing trajectories. *Curr Probl Surg.* 2001 February;38(2):72–140.
25. Robson MC, Shaw RC, Hegggers JP. The reclosure of postoperative incisional abscesses based on bacterial quantification of the wound. *Ann Surg.* 1970;171:279–82
26. Suarez Acosta CE, Romero Fernandez E, Calvo Manuel E. Epigastric Hernia. *Indian J Surg.* 2015;77(4):335Wang R, Qi X, Peng Y, Deng H, Li J, Ning Z, Dai J, Hou F, Zhao J, Guo X. Association of umbilical hernia with volume of ascites in liver cirrhosis: a retrospective observational study. *J Evid Based Med.* 2016 Nov;9(4):170-180.
27. Rutkow IM. Epidemiologic, economic, and sociologic aspects of hernia surgery

- in the United States in the 1990s. *Surg Clin North Am.* 1998 Dec;78(6):941-51, v-vi.
28. Fathi AH, Soltanian H, Saber AA. Surgical anatomy and morphologic variations of umbilical structures. *Am Surg.* 2012 May;78(5):540-4.
 29. Celdrán A, Bazire P, Garcia-Ureña MA, Marijuán JL. H-hernioplasty: a tension-free repair for umbilical hernia. *Br J Surg.* 1995 Mar;82(3):371-2.
 30. Belghiti J, Durand F. Abdominal wall hernias in the setting of cirrhosis. *Semin Liver Dis.* 1997;17(3):219-26.
 31. Kulaçoğlu H. Current options in umbilical hernia repair in adult patients. *Ulus Cerrahi Derg.* 2015;31(3):157-61.
 32. Forrest JV, Stanley RJ. Transverse colon in adult umbilical hernia. *AJR Am J Roentgenol.* 1978 Jan;130(1):57-9.
 33. Zens TJ, Rogers A, Cartmill R, Ostlie D, Muldowney BL, Nichol P, Kohler JE. Age- dependent outcomes in asymptomatic umbilical hernia repair. *Pediatr Surg Int.* 2019 Apr;35(4):463-468.
 34. Pallister ZS, Angotti LM, Patel VK, Pimpalwar AP. Transumbilical repair of umbilical hernia in children: The covert scar approach. *J Pediatr Surg.* 2019 Aug;54(8):1664-1667.
 35. Zens T, Nichol PF, Cartmill R, Kohler JE. Management of asymptomatic pediatric umbilical hernias: a systematic review. *J Pediatr Surg.* 2017 Nov;52(11):1723-1731.
 36. Abdulhai SA, Glenn IC, Ponsky TA. Incarcerated Pediatric Hernias. *Surg Clin North Am.* 2017 Feb;97(1):129-145
 37. HEIFETZ CJ, BILSEL ZT, GAUS WW. Observations on the disappearance of umbilical hernias of infancy and childhood. *Surg Gynecol Obstet.* 1963 Apr;116:469-73
 38. Jackson OJ, Moglen LH. Umbilical hernia. A retrospective study. *Calif Med.* 1970 Oct;113(4):8-11.
 39. Walker SH. The natural history of umbilical hernia. A six-year follow up of 314 Negro children with this defect. *Clin Pediatr (Phila).* 1967 Jan;6(1):29-32.
 40. Haller JA, Morgan WW, White JJ, Stumbaugh S. Repair of umbilical hernias in childhood to prevent adult incarceration. *Am Surg.* 1971 Apr;37(4):245-6
 41. Mittal T, Kumar V, Khullar R, et al. Diagnosis and management of Spigelian hernia: A review of literature and our experience. *J Minim Access Surg.* 2008;4(4):95-98.
 42. Klinge U., Prescher A., Klosterhalfen B., Schumpelick V.
Entstehung und Pathophysiologie der Bauchwanddefekte. *Chirurg.* 1997;68.4:293-303.
 43. Ellis H., Watson C. *Lecture Notes of Surgery.* tenth ed. Blackwell publishing company; U.S.A: 2002. Hernia; pp. 231-241.
 44. Farquharson Margaret, Hollingshead James, Moran Brendan., editors. *Farquharson's Textbook of Operative General Surgery.* CRC Press; 2014. p. 222.