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Original article

Comparative Study between Anterior Components Separation versus Posterior Components Separation Technique in Repairing of Huge Ventral Hernia

Ahmed M. Nawar, Hamdy H. Abd Elhady, Mohamed M. Deabs, Mohammed A. Fadey

General Surgery Department, Faculty of Medicine Benha University, Egypt.

Corresponding to: Hamdy H. Abd Elhady, General Surgery Department, Faculty of Medicine Benha University, Egypt.

Email:

hmdyhsn789@gmail.com

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Abstract

Background: Ventral abdominal wall hernias of the complicate between 11% and 23% of all abdominal laparotomies, constituting a growing problem. Contemporary general surgeons are confronted with the significant challenge of performing dependable, long-lasting ventral hernia repairs with minimal morbidity and recurrence. We aimed to compare between anterior components separation and posterior components separation technique in repair huge ventral hernia as regard degree of medialization myofascial flap, wound morbidity and recurrence rate. **Methods:** This prospective randomized controlled study was conducted on 62 huge incisional hernia patients aged more than 18 years old, both sexes. Group A: n= 31, underwent anterior component separation (CS). Group B: n= 31, underwent posterior CS. All patients underwent to detailed history full clinical examination and investigation. physical examination, laboratory examination [complete blood count, bleeding profile, renal and liver function tests, and fasting blood sugar], and radiological examination **Results:** A statistically significant distinction observed among the studied groups as regard seroma and wound infection which occurred more in anterior separation technique repair of huge incisional hernia. **Conclusions:** Anterior separation technique repair of huge incisional hernia is more liable to complications as seroma and wound infection than posterior separation technique repair of huge incisional hernia.

Keywords: Ventral Abdominal Wall Hernia; Abdominal Laparotomy; Myofascial Flap; Anterior Components Separation; Posterior Components Separation**.**

Introduction

Multilaminar mirror-image muscles comprise the anterior abdominal wall; the paired rectus abdominis muscles insert superiorly on the ribs from the pubis inferiorly. The insertion site for the lateral musculature is the linea semilunaris, which is located at the lateral margin of the rectus abdominis muscles. The semicircular line is defined by the lower edge of the posterior sheath, which is positioned

midway between the umbilicus, the pubis, and its concavity is directed towards the pubis. The anterior and posterior laminae originate from the division of the internal oblique aponeurosis above this line. These fibers are decussated from the various aponeurotic layers along the midline linea alba [1].

Incisional abdominal wall hernias complicate between 11% and 23% of all abdominal laparotomies, constituting a growing problem. Contemporary general surgeons are confronted with the significant challenge of performing dependable, long-lasting incisional hernia repairs with minimal morbidity and recurrence. Failure rates associated with hernia repair vary between 25% and 54% for primary suture repair and up to 32% for open mesh repair [2].

Huge hernias are more susceptible to complications and are difficult to manage with external assistance. There are several complications associated with the management of such huge hernias, the first of which is the difficulty of reducing the contents, patients are at high risk due to complications such as pulmonary embolism, postoperative complications in the cardiovascular system, and increased intraabdominal pressure. A high risk of recurrence is associated with the size of the hernia [3]

There are plenty of proposed options for the repair of huge hernias. Pneumoperitoneum and musculoskeletal flaps are described for abdominal rooming. Pneumoperitoneum is an invasive procedure that may lead to sporadic complications, including air embolism, peritonitis, viscera perforation, and abdominal wall hematoma. Musculoskeletal flaps necessitate extensive dissection, which carries the risk of necrosis of the flap, blood loss, and complications related to donor site [4]

Component separation (CS) has evolved into a vital step when addressing large and complex defects during incisional hernia repair. By manipulating the myofascial components of the abdominal wall made the surgeons able to utilize the most recent in mesh reinforcement without having to perform bridging repairs or restore linea alba [5]

We aimed to compare between anterior components separation and posterior components separation technique in repair huge incisional hernia as regard degree of medialization myofascial flap, recurrence rate and wound morbidity.

Patients and Methods:

This prospective randomized controlled study was conducted on 62 huge incisional hernia patients aged more than 18 years old, both sexes. The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, Benha University.

The patient provided written consent that was informed. the research was conducted following approval from the Ethical Committee of Benha University Hospitals,

Study Location: Banha University Hospital **Study Duration:** January 2023 - January 2024

Inclusion criteria: Age more than 18 years old and huge incisional hernia (recurrent, and post midline incision)

Exclusion criteria were age more than 65 years old, uncontrolled DM (HBA1C > 9), compromised cardiopulmonary functions, increase surgical risk from systemic illness according to anesthesiologist's physical status American society classification.

Grouping: Patient allocated into two groups; **Group A:** n= 31, subjected to

anterior CS. **Group B:** n= 31, went through posterior CS.

The study patients underwent detailed history, physical examination, laboratory examination [complete blood count, bleeding profile, tests of renal and liver function, and fasting blood sugar], and full clinical examination, and investigation.

Radiological Examination: include pelvi abdominal ultrasound, pelvis and abdomen CT scan, ECG, echocardiography, chest X ray and pulmonary function test.

Procedure

anterior CS: The procedure purpose is to divide the aponeurosis and muscle of the external oblique, which is relatively fixed, to raise the rectus abdominis muscle from its posterior rectus sheath, and subsequently to medially mobilize the myofascial flap composed of the transversus abdominis, rectus, and internal oblique muscles. A relatively avascular plane can be utilized to divide the external oblique muscle from the internal oblique muscle for anatomical studies. Approximately 8 centimeters around the waistline, this will facilitate the progression of the transversus abdominis muscles, rectus muscular block, and internal oblique. The external and internal oblique muscles surgical separation to the posterior axillary line frequently enables mobilization of each rectus muscle unit for 8cm around the waistline on each side of the abdominal wall, despite the frequent attenuation or displacement of the abdominal wall structures. By further separating the rectus muscle from the posterior rectus fascia above the arcuate line, the medial muscle can advance by an additional 2 cm at each level [6].

Figure (1): Dissected anterior rectus sheath

Figure (2) Closed hernial defect

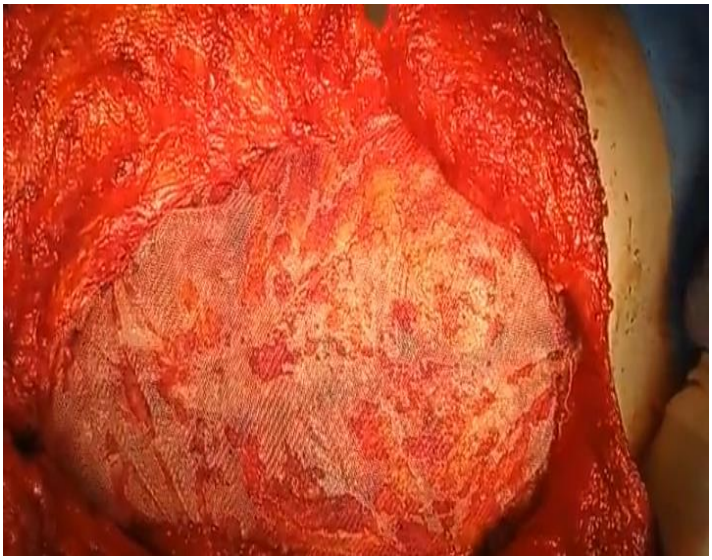

Figure (3) Onlay mesh fixation

Posterior CS: A midline laparotomy is performed with complete lysis of adhesions. Retromuscular space is developed by incising the posterior rectus sheath and dissecting the rectus muscle anteriorly. Once the lateralmost edge of the rectus sheath is reached, the posterior rectus sheath is incised, dividing the posterior aponeurotic sheath of the internal oblique muscle. This allows access to the plane between the internal oblique and transversus abdominis muscle. Dissection is carried out as far lateral, inferior, and superior as desired, allowing for a large mesh underlay. The posterior rectus sheath is then reapproximated in the midline with a running suture. The mesh is placed in the retromuscular space and secured with sutures. The anterior rectus sheath is then reapproximated in the midline to cover the mesh. [7].

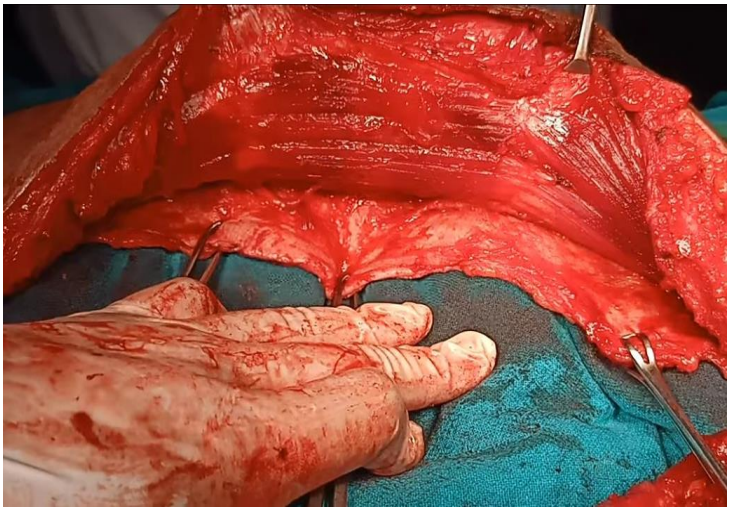

Figure (4) Dissected posterior rectus sheath

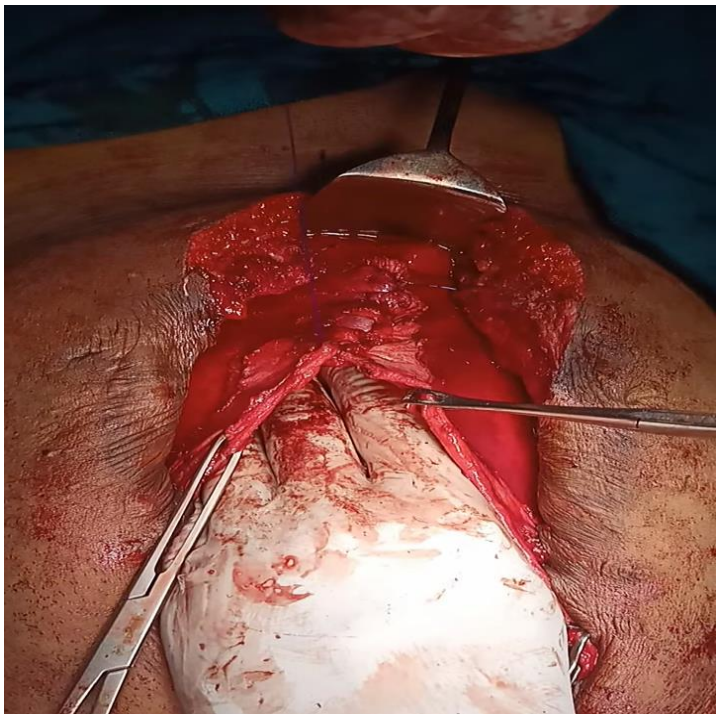

Figure (5) Closure of posterior rectus sheath

Postoperative care:

All patients were followed for two weeks for early post operative complication include wound infection, bleeding, seroma, hematoma, and wound dehiscence.

Enhanced recovery program was followed up including patient education, patient admission, minimal optimization prior to fasting that includes a carbohydrate beverage two hours beforeanesthesia, multimodal analgesia with appropriate use of opioids when indicated, return to normal diet and activities the day of surgery, and return home.

The impact of the repair and reconstruction on these patients' quality of life was measured using the HerQLes assessment tool. Scores were calculated at the preoperative appointment and at a 6-month postoperative visit with a global follow-up period at least 9 months following surgery. The scores from the

Rasch modeling were transformed to a 100-point scale (0 to 100, with high scores indicating a high quality of life) to establish the final HerQLes score. With this scale, mean baseline HerQLes score was 47.2.

Outcome: - primary outcome: proper repair of hernia with minimal postoperative complications. secondary outcome: decrease overall cost and hospital stay.

Approval Code: Ms.49-10-2022

Statistical analysis

SPSS v26 was utilized for the statistical analysis (IBM Inc., Armonk, NY, USA). The means and standard deviations (SD) of quantitative variables were utilized to compare the two groups with an unpaired Student's t-test. The frequency and percentage (%) values of qualitative variables were utilized in the analysis, with the appropriate tests being the Chi-square test or Fisher's exact test. A two-tailed P value < 0.05 was deemed to indicate statistical significance.

Results:

The mean age of included patient in group A 50.5 years and group B 46.8 years, also the mean BMI of group A 34.43 kg/m^2 and group B 34.39 kg/m^2, no statistically significant difference was observed among the other sociodemographic data. (Table 1).

The mean defect width in group A 10.43 cm and group B 11.07 cm, the mean operative time in group A 211.75 mins and group B 215.25 mins, the mean blood loss in group A 512.5 cc and group B 537.5 cc, no statistically significant difference is noted between the groups under study according to operative data (Table 2).

There was no significant difference between the two groups regarding basic activity. Although, there was a lower significant difference in Group B PCS than Group A ACS regarding and home and work activity. No statistically significant difference was observed between the groups that were examined as regard recurrence, abdominal wall stiffness, foreign body sensation, and loss or change in sensation. Comparing the groups under the study in terms of seroma and wound infection showed statistically significant differences (Table 3).

There was statistically significant difference between the studied group as regard seroma and surgical wound infection show that ACS has less complication than PCS.

patients with higher grade hernias and an active smoking history had lower baseline HerQLes scores on average (p 0.06; p 0.03, respectively). On average, there was a significant increase from baseline HerQLes scores at 4 weeks and 6 months after surgery. Patients continued to show a significant improvement in quality of life between 4 weeks and 6 months (p 0.01)

All patients experienced an individual improvement in their postoperative HerQLes quality of life score and no statistically significant differences between the studied groups (Table 4).

Table 1: Sociodemographic data of both groups

		Group A ACS (n=31)	Group B PCS (n=31)	Test of Sig.	p
Age (years)		50.5 ± 14.16	46.8 ± 11.32		
Sex	**Female**	15(48.4%)	13(41.9%)	χ^2= 0.1	0.752
	Male	16(51.6%)	18(58.1%)		
Comorbidities	**Diabetes Mellitus**	9(29%)	9(29%)	χ^2=0	1
	Hypertension	7(22.6%)	10(32.3%)	χ^2=0.476	0.519
	Smoking	10(32.3%)	13(41.9%)	χ^2=0.417	0.526
BMI groups	**Normal range**	0(0%)	0(0%)	-	
	Pre obese	4(12.9%)	6(19.4%)	χ^2=0.119	0.730
	Obese class I	13(41.9%)	7(22.6%)	χ^2=1.845	0.174
	Obese class II	14(45.2%)	18(58.1%)	χ^2=0.581	0.446
BMI		34.43 ± 4.32	34.39 ± 4.38		
Surgical History	**Blunt trauma**	9(29%)	12(38.7%)	χ^2=0.41	0.815
	Penetrating trauma	4(12.9%)	2(6.5%)	χ^2=1.876	0.453
	Intestinal obstruction	8(25.8%)	8(25.8%)	χ^2=0	1
	Peritonitis	5(16.1%)	7(22.6%)	χ^2=0.173	0.677
Occupation	**Student**	2(6.5%)	1(3.2%)	χ^2=1.875	0.176
	Hard worker	12(38.7%)	13(41.9%)	χ^2=0.312	0.986
	Employee	10(32.3%)	11(35.5%)	χ^2=0.367	0.875
	Retired	7(22.6%)	6(19.4%)	χ^2=0.217	0.924

Data are presented as mean ± SD and number (%). SD: Standard deviation, χ2: Chi square test, t: student t-test, p: p value for comparing between studied groups, *: Statistically significant at $p \leq 0.05$

Table 2: Comparison between studied cases according to operation data

		Group A ACS (n=31)	Group B PCS (n=31)	Test of Sig.	p
Defect width (cm)		10.43 ± 3.34	11.07 ± 2.38	t= 0.693	0.493
Site	Supraumblical	11(35.5%)	11(35.5%)	χ^2=0.00	1
	Infraumblical	10(32.3%)	11(35.5%)	χ^2=0.072	0.942
	Umblical	10(32.3%)	9(29%)	χ^2=0.075	0.964
Content	Bowel	20(64.5%)	19(61.3%)	χ^2=4.13	0.974
	Omentum	11(35.5%)	12(38.7%)	χ^2=0.411	0.983
Operative time (min)	Range.	150 – 285	155 – 270	t= 0.262	0.795
	Mean ± SD.	211.75 ± 45.8	215.25 ± 38.44	---	---
Blood loss (cc)	Range.	350 – 800	300 – 850	t= 0.498	0.622
	Mean ± SD.	512.5 ± 135.6	537.5 ± 179.09	---	---

Data are presented as mean ± SD and number (%). SD: Standard deviation, χ2: Chi square test, t: student t-test, p: p value for comparing between studied groups, *: Statistically significant at $p \leq 0.05$

Table 3: Comparison between studied cases according to long term of complication, wound complications, return to activity.

	Group A ACS	Group B PCS	Test of Sig.	p
	(n=31)	(n=31)		
Basic activity	1.7 ± 1.6	1.5 ± 1.4	0.608	0.543
Home activity	5.6 ± 1.2	4.6 ± 1.1	4.084	<0.001*
Work activity	19.2 ± 3.4	18.1 ± 2.5	2.515	0.012*
long term of complication				
Recurrence	3 (9.7%)	2 (6.5%)	0	0.350
Abdominal wall stiffness	5 (16.1%)	2 (6.5%)	0.644	0.422
Foreign body sensation	8 (25.8%)	2 (6.5%)	2.981	0.084
Loss or change in sensation	6 (19.4%)	3 (9.7%)	0.520	0.471
Wound complications			χ^2	p
Seroma	9(29%)	4(12.9%)	6.465	0.011*
Surgical wound infection	7(22.6%)	1(3.2%)	10.157	0.001*
Wound dehiscence	3(9.7%)	2(6.5%)	0.143	0.705
Chronic sinus	1(3.2%)	0(0%)	2.105	0.147

Data are presented as mean ± SD and number (%). $\chi 2$: Chi square test, p: p value for comparing between studied groups, *: Statistically significant at $p \leq 0.05$

Table 4: Comparison between studied cases according to pre and post operative HerQles score

	Group A ACS	Group B PCS	Test of Sig.	p
	(n=31)	(n=31)		
Mean pre operative HerQles score	22.2± 6 Range (14–33)	25±7.2 Range (16–34)	4.084	0.09
Mean pre operative HerQles score	54.5±13.6 Range(35–70)	57.9±14.1 Range(38–75)	2.515	0.14

Data are presented as mean ± SD

For the following statements, please circle the number that is most appropriate for you.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately	Strongly Agree
1. My abdominal wall has a huge impact on my health	1	2	3	4	5	6
2. My abdominal wall causes me physical pain	1	2	3	4	5	6
3. My abdominal wall interferes when I perform strenuous activities, e.g., heavy lifting	1	2	3	4	5	6
4. My abdominal wall interferes when I perform moderate activities, e.g. bowling, bending over	1	2	3	4	5	6
5. My abdominal wall interferes when I walk or climb stairs	1	2	3	4	5	6
6. My abdominal wall interferes when I dress myself, take showers and cook	1	2	3	4	5	6
7. My abdominal wall interferes with my sexual activity	1	2	3	4	5	6
8. I often stay home because of my abdominal wall	1	2	3	4	5	6
9. I accomplish less at home because of my abdominal wall	1	2	3	4	5	6
10. I accomplish less at work because of my abdominal wall	1	2	3	4	5	6
11. My abdominal wall effects how I feel every day	1	2	3	4	5	6
12. I often feel blue because of my abdominal wall	1	2	3	4	5	6

Figure (4) HerQles score

Discussion

Ventral abdominal wall hernias complicate between 11% and 23% of all abdominal laparotomies, constituting a growing problem. Contemporary general surgeons are confronted with the significant challenge of performing dependable, long-lasting ventral hernia repairs with minimal morbidity and recurrence. Failure rates associated with hernia repair vary between 25% and up to 32% for open mesh repair and 54% for primary suture repair [2].

Our research revealed that no statistically significant difference existed between the groups under investigation as regard history data, BMI or defect width. This is consistent with the findings of the research [8] which discovered that demographic information and BMI did not differ significantly between the two groups; however, patients undergoing ACS had a slightly higher mean BMI (31.4 kg/m2) than those undergoing TAR (29.5 kg/m2). The defect width was 9.64 (6-15) cm vs 10.4 (6-14.6) cm in ACS &TAR respectively. In contrast to other study [9] it was found that hernia width was 17 ± 8 cm. A different study [10] found that mean defect width was 14.5±193 vs 14.9±1.77 in group A(ACS) & group B(PCS) which was not significant.

Our study found that there was no statistically significant difference between the studied groups as regarding operative data. As mean operation time was 211.75 ± 45.8 vs 215.25 ± 38.44 minutes in group A & group B respectively, also most of wounds were clean which is consistent with the study [11] which proved that wound classification was clean in 100%vs 95.6%in ACS &PCS respectively. In contrast to the former study [10] which found that the mean operative time in group B was significantly higher than group A as mean operation time was 254.25±22.79 mins vs 267.5±16.1 mins in group A & group B respectively, with P value 0.040. A study found that the median operative time in PCS was signifcantly higher than in ACS (240 min Vs. 210 min, p<0.001) [11]. Also, another study [8] found that the mean operative time was significantly longer for ACST (227 minutes "vs. 276 minutes, p = 0.007) than that for TAR.

Regarding the mean blood loss was 512.5 ± 135.6 vs 537.5 ± 179.09 cc in group A & group B respectively which not statistically significant which is consistent with Soliman et al [10] who found that there was no significant difference in blood loss it was 236.5 ml in group A (ACS) versus 251.5 ml in group B (PCS with TAR), with P value 0.201. In the study done 2012 [2] the mean blood loss was 188 cc, which was less than our study because they were the first to describe the TAR technique, having more experience in this technique. Also, another study [11] found that PCS had signifcantly higher estimated intraoperative blood loss (240 cc vs. 175 cc, p< 0.001. It was reported that reported that the estimated blood loss for ACST on average was 189 cc while for TAR it was 225 cc (p = 0.296) no significant [8].

We found that there was no significant different between the two groups regarding basic activity. However, there was a higher significant different in Group A ACS than Group B PCS regarding and home and work activity.

Patients who underwent CS for huge incisional hernias reported a significant reduction in activity limitation and an improvement in their quality of life [12].

An additional prospective study comparing 710 laparoscopic repairs over the long term found that short-term quality of life, length of stay, and infection rates were all reduced; however, long-term complications and recurrence rates remained unchanged [13].

The incidence of postoperative complications was found to be higher in the cohort of 30 patients examined [14]. Reherniation was detected in 10% of the patients following an average of 12 months of follow-up.

DiBello and Moore used the ACS technique in 35 patients, and in none of the patients a release of the posterior rectal sheath was done, and in 15 patients midline closure was supported by an on-lay prosthesis [15]. Postoperative wound complications were reported in 14%, and recurrence was found in 9% after a mean follow-up of 22 months. Girotto et al. applied the original technique in 30 patients. Postoperative wound complications were reported in 27%, with recurrence rate of 6% after a mean follow-up of 21 months [16]. I applied the same technique as DiBello and Moore to 22 patients in this study. 14% of the patients reported postoperative wound complications. A mean follow-up of 52 months revealed a recurrence in 5% of the patients. Postoperative complications were more frequent in the series of studies, which reported on 30 patients. [14]. Reherniation was found in 10% of the patients after a mean follow-up of 12 months. In our study, 31 patients underwent ACS and were followed up for 15 months; surgical site infection was reported in 22.5% of cases, with 9.7% wound dehiscence, and necrotizing wound infections occurred in four cases and required surgical wound debridement with removal of parts of the mesh. Recurrence was reported in 9.7% of cases after 15 months follow-up.

Numerous institutions that have evaluated the results of the PCS technique in conjunction with TAR have observed encouraging outcomes, such as reduced rates of wound infection. Initial accounts of the application of TAR, beginning with a case series of 42 patients undergoing TAR, were presented [2]. These accounts revealed a wound infection rate of 7.1% and a recurrence rate of 4.7%, with an average follow-up period of 26 months. Furthermore, an additional study involving 55 patients was conducted, which revealed a wound infection rate of 10% and a recurrence rate of 3.6% after an average of seven months of follow-up [17]. During a one-year follow-up period, our study of 31 patients who underwent PCS with TAR revealed a 6.5 % recurrence rate and a 3.2 % surgical wound infection and 6.5% wound dehiscence, respectively. Mesh removal was not necessary during surgical debridement because the infection was contained within the sublay mesh which is .less than ACS

There was statistical significant difference between the studied group as regard seroma and surgical wound infection show that ACS has less complication than PCS with p value 0.011 for seroma and 0.001 for wound infection.

A surgical wound seroma was documented in 29 % of the patients in the ACS group, which is an expected complication of this technique due to the excessive skin flaps. Similarly, it occurred in 12.9% of the PCS with TAR group, which may be a consequence of the undesected subcutaneous hernia sac.

A study found that regarding readmissions and reoperations occurring within 30 days,

no significant difference was observed between groups A and B. Recurrence, wound complications, and GIT complications contributed 10%, 0%, and 20%, respectively, to the differentiation in group B. In contrast, these factors accounted for 35%, 10%, and 10% in group A [18]. This comes in parallel with the results of others [19].

This finding aligns with the results of a retrospective comparative study which revealed that there was a significantly higher incidence of wound complications in open anterior CST (48.2% vs. 25.5%, p = 0.01) than in open posterior CST [17]. Additionally, the open anterior CST group had a higher recurrence rate (14.3 vs 3.6%, p = 0.09). In addition, researchers discovered surgical site occurrence rates of 20.3% for posterior CST with TAR and 21.4% for the open anterior approach in a recent systematic review [20]. Furthermore, our findings align with others [10] who reported that regarding the incidence of wound seroma and wound infection, there was a significant difference between the two groups in favor of the PCS with TAR group (40% n ACS group vs. 10% in PCS-TAR group in seroma and 40% in ACS group vs. 5% in PCS with TAR group in wound infection) and recurrence rate (35% in the ACS vs. 5% in the PCS with TAR p value 0.037. This is in contrast others [19] who found that the incidence of wound seroma was higher than ours (70% in the ACS group versus 35% in the PCS with TAR group), also had higher wound infection rate than ours in group B (PCS) (50% in ACS vs. 20% in PCS with TAR). Additionally, scientists [21] discovered a 6% recurrence rate in PCS, which is slightly higher than the 12% recurrence rate observed in minimally invasive ACS.

Also, it was reported that total 8(34.78%) patients developed complications [7]. Complications were more in ACS technique. Out of 5 cases of ACS, 4 developed complications. Other studies showed that the complications of ACS were high (>60%) [22 &23]

Limitations: Small sample size of the studied groups and this is a unicenter study further multicenter studies needed to strengthen our results.

We recommended that further research be conducted on large geographical scale and on longer period and larger sample size of follow up to emphasize our conclusion. Further studies with a large number from different centres will be necessary to compare between anterior components separation and posterior components separation technique in repair huge Incisional hernia as regard degree of medialization myofascial flap, wound morbidity and recurrence rate. Using posterior separation technique repair of huge Incisional hernia.

the mean HerQLes score for patients with a wide variety of hernias was 47.2. Patients with more complex hernias had lower HerQLes scores, and later studies demonstrated a correlation between improved abdominal function and increasing HerQLes scores krpata et al [17] All patients in our study experienced an individual improvement in their postoperative HerQLes quality of life score.

Conclusion

Anterior separation technique repair of huge Incisional hernia more liable to complications as seroma and wound infection than posterior separation technique huge ventral hernia repair.

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