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Early Outcome after Sublay versus Onlay Polypropylene Mesh Repair for Ventral Midline Incisional Hernia – A Single Center Retrospective Analysis

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Rezumat

Rezultate pe termen scurt ale intervențiilor chirurgicale cu montare de plasă de polipropilenă onlay vs sublay pentru eventrațiile mediane - analiza retrospectivă a experienței unui singur centru

Context: Plasarea onlay şi sublay retromuscular a plaselor sintetice sunt cele mai folosite modalități de rezolvare a eventrațiilor mediane în chirurgia deschisă. Plasarea onlay este simplă şi rapidă, pe când plasarea sublay retromusculară oferă o protecție suplimentară împotriva infecției dar este considerată ca fiind o tehnică mai complicată cu un risc crescut de complicații postoperatorii precoce. Experiența personală a chirurgului are şi ea un rol important în alegerea modalității de plasare a plasei.
Material şi metodă: Lucrarea de față prezintă rezultatele unei analize retrospective a 220 de pacienți operați în Clinica Chirurgie a Spitalului Clinic Județean Mureş (România) în perioada 31.01.2017 – 31.12.2019 cu plasă de polipropilenă montată sublay retromuscular sau onlay pentru eventrație mediană post-operatorie. Pacienții au fost împărțiți în două loturi în funcție de poziția plasei. Cele două grupuri au fost identice în ceea ce priveşte vârsta, distribuția pe sexe, incidența comorbidităților (obezitate, diabet zaharat, afecțiuni cardiace şi respiratorii), numărul de operații anterioare şi dimensiunea defectului (valoarea $p > 0,05$ pentru toți parametrii).
Rezultate: Mortalitatea postoperatorie a fost zero, neexistând diferențe semnificative statistic ale duratei spitalizării post-

operatorii între cele două loturi (p > 0,05). Un total de 34 de reoperații precoce au fost necesare pentru hematom, necroză cutanată, serom, supurație a plăgii şi ocluzie intestinală, fără diferențe semnificative statistic între cele două grupuri (p > 0,05 pentru incidența globală şi separată a fiecărei complicații). Plasarea onlay a plasei a fost asociată cu o îndepărtare mai tardivă a drenurilor superficiale (p < 0,0001) cu o proporție mai mare de pacienți care au fost externați fără îndepărtarea drenurilor (grupul A 2/62 față de grupul B 141/168, p<0,0001).
Concluzii: Ambele modalități (onlay sau sublay retromuscular) de plasare a plaselor de polipropilenă pot fi folosite cu rezultate bune în tratamentul eventrațiilor mediane. Absența unei morbidități precoce suplimentare la plasarea retromusculară a plasei este un argument pentru folosirea mai frecventă a acestei tehnici care oferă o protecție suplimentară împotriva infecției.

Cuvinte cheie: eventrație, onlay, sublay, retromuscular, polipropilenă, plase sintetice

Abstract
Context: Onlay and retromuscular sublay mesh repairs are the most frequently used procedures in open repair of midline incisional hernias. The onlay placement of the mesh is simple and fast to perform, while the sublay retromuscular repair offers a supplementary protection against infection, but it is considered a more complicated procedure with a higher risk of early postoperative complications. The personal experience of the surgeons plays an important role in choosing the technique of mesh placement.
Material and methods: This paper presents the results of a retrospective analysis of 220 consecutive patients operated on in the Surgical Clinic of the Mureş Clinical County Hospital (Romania) between 31.01.2017 – 31.12.2019 with sublay or onlay polypropylene mesh repair for ventral midline incisional hernia. The patients were divided into two groups according to the position of the mesh. The two groups were identical in terms of age, sex distribution, incidence of comorbidities (obesity, diabetes mellitus, cardiac and respiratory diseases), number of previous operations and size of the defect (p value >0.05 for all the parameters).
Results: Postoperative mortality was zero, with no statistically significant differences of the duration of the postoperative hospitalization between the two groups p > 0.05. A total of 34 early reoperations were required for hematoma, skin necrosis, seroma, wound suppuration, and intestinal obstruction, with no statistically significant difference between the two groups (p > 0.05 for the overall and separate incidence of each complication). The onlay placement of the mesh was associated with a later removal of the superficial drains p < 0.0001 with a larger proportion of the patients who were discharged without removing the drains (group A 2/62 versus group B 141/168, p < 0.0001).
Conclusions: Both the onlay and the retromuscular sublay placement of polypropylene meshes may be used with good results for the treatment of midline incisional hernias. The lack of a supplementary early morbidity after the retromuscular sublay repair is an argument for a more frequent use of this technique which offers a supplementary protection against infection.

Key words: incisional hernia, onlay, sublay, retromuscular, polypropylene, mesh repair

Introduction

The modern open repair of the ventral midline incisional hernia is based on the use of synthetic meshes which allows a tension-free and solid reconstruction of the abdominal wall resulting in a quick recovery and low rate of recurrence (1-3). The main possibilities to place the mesh are sublay (retromuscular – behind the rectus abdominis muscle) and

onlay (overlying the closed fascial defect), each of them with advantages and disadvantages. The onlay placement of the mesh is considered to be easier to perform and learn, but it requires sectioning of some perforator skin vessels with associated ischemia while the subcutaneous placement of the mesh increases the risk of seroma and infection. The retrosmuscular placement of the mesh avoids the devascularization of the overlying skin by performing the dissection in an avascular plane below the perforator vessels while the direct contact of the mesh with the muscle protects against seroma and infection. However, the retromuscular mesh placement is considered to be more difficult and time-consuming to perform, with an increased risk of bleeding. In the available literature, there are no large prospective randomized studies allowing a clear conclusion while the results achieved by highly trained hernia surgeons are not always reproductible by general surgeons with no special training and interest in abdominal wall reconstruction (4,5). The aim of this study is to compare the early outcome/morbidity of the two methods of mesh placement by performing a retrospective analysis of a non-randomized series of 220 consecutive patients operated on in a single center during a period of 3 years.

Materials and Methods

Patients

We performed a retrospective analysis of 220 consecutive patients operated on in the Surgical Clinic of Mureş County Clinical Hospital (Romania) between 31.01.2017 – 31.12.2019 with sublay or onlay polypropylene mesh repair for ventral midline incisional hernia. Patients with primary defects (umbilical or epigastric hernia), other locations of the defects (non-midline) or other types of repair (non-mesh repair, inlay or intraperitoneal – including laparoscopic) were not included. The patients were divided into two groups: group A – 62 patients with sublay repair (mesh placed retromuscularly between the rectus abdominis muscle and the posterior rectus sheet) and group B – 158 patients with onlay repair (mesh placed overlying the closed fascial defect). The procedures were performed by a total number of 11 surgeons and the exact type of repair was decided by the operating surgeon based on the intraoperative findings and personal preference. The research was conducted according to the current international recommendations and guidelines on medical research involving human subjects (World Health Organization/ World Medical Association – updated Declaration of Helsinki). All the patients signed an informed consent, and the study was approved by the local Ethical Committee of the Mureş County Clinical Hospital (714/15.01.2021).

Statistical Analysis

The two groups were first compared in terms of general characteristics (age, sex) and other factors known to be associated with an increased risk of early postoperative complications (incidence of obesity, diabetes, cardiac diseases, respiratory diseases), the number of previous operations and the dimensions of the defects. The early outcome was analyzed by comparing the postoperative mortality, hospi-talization (number of days after surgery), the incidence of complications requiring early reoperations (bleeding, seroma, skin necrosis, wound suppurations), postoperative drainage (number of superficial drains placed, the duration of the drainage and the number of patients discharged with the drains in place). The data were collected using Microsoft Excel datasheets and analyzed using the GraphPad Prism 8.4.3. software for statistical analysis (GraphPad Software, San Diego, CA 92108). Data were expressed as ranges, mean and standard deviation. The Kolmogorov-Smirnov test was used to evaluate the normal (Gaussian) distribution while the two groups were compared using the Mann Whitney, Fisher's exact test and the unpaired t test (as appropriate for each situation) with a p value < 0.05 considered to be statistically significant.

Results

Characteristics of the two groups

Age and sex distribution

The overall age of the patients ranged between 23 and 89 years, with a mean of 61.2±11.5 years, with no statistically significant differences between the two groups: group A – ranges 33-89 years, mean 63.2±11.4 years versus group B – ranges 23-86 years, mean 61.3±10.8 years, p = 0.3 (unpaired t test). No statistical significance was noted concerning the male/female ratio between the two groups: group A 15/47 versus group B 42/116, p = 0.864 (Fisher's exact test).

Comorbidities

A significant number of patients presented with associated diseases known to have a negative impact on the postoperative evolution in abdominal wall surgery: obesity – 87 pts., diabetes mellitus – 37 pts, cardiac disease – 118 pts., respiratory diseases – 72 pts. The comparative statistical analysis of the incidence of these comorbidities showed no statistically significant differences between the two groups (Fisher's exact test – p > 0.05 for all the parameters, see *Table 1* for details).

The dimensions of the defect

The overall dimensions of the defects ranged between 1 and 21 cm (evaluated intraoperatively), with no statistically significant difference between the two groups: group A ranges 2-20 cm with a mean of 7.3±4.3 cm versus group B ranges 1-21 cm with a mean of 7.2±4.2 cm, p = 0.834 (Mann-Whitney test).

The number of previous operations performed

The number of previous operations performed ranged between 1 and 7. We found no statistically significant difference between the two groups: group A – ranges 1-6 and a mean of 1.9±1.0 procedures/patient versus group B – ranges 1-7 and a mean of 1.7± 1.0, p = 0.3841 (Mann-Whitney test). We have to note that group A included 6 patients with recurrence after the onlay repair.

Postoperative mortality

In this group of patients, we encountered no postoperative death.

Hospitalization

The overall postoperative hospitalization ranged between 2 and 56 days. A comparative analysis showed a very slightly longer hospitalization in the sublay group but without reaching a statistically significant value (group A – ranges 4-56 days with a mean of 10.4±8.2 days versus group B – ranges 2-28 days with a mean of 9.1±3.8 days, p = 0.909 (Mann Whitney test).

Early reoperations

In this series of patients, 34 reoperations were required for evacuation of hematoma and hemostasis – 7 cases, drainage of seroma – 9 cases, excision and secondary suture for skin necrosis – 6 cases, wound suppuration – 11 cases, and intestinal obstruction – 1 case. The rate of re-operations was not different between the two groups (group A – 6/62 patients versus group B 28/158, p > 0.05). A detailed analysis for each complication/ type of

Comorbidity	Group A (62 patients)	Group B (158 patients)	OR / 95% CI	p value (Fisher's exact test)
Obesity*	24	63	0.95 / 0.53-1.73	>0.999
Diabetes mellitus**	13	24	1.86 / 0.88-3.84	0.140
Cardiac disease**	33	85	0.81 / 0.46-1.41	0.472
Respiratory disease**	22	50	1.29 / 0.69-2.42	0.426

Table 1. Comparative analysis of the incidence of the comorbidities in the two groups

* defined according to body mass index

** diagnosed by specialist physician + specific treatment required

Table 2. Comparative incidence of complications

Complication*	Group A (62 patients)	Group B (158 patients)	RR 95% CI	OR / 95% CI	p value (Fisher's exact test)
bleeding	0	7	0.0 0.0 – 1.11	0.0 0.0 – 1.21	0.101
skin necrosis	2	4	1.16 0.33 – 2.56	1.24 0.23 – 5.43	>0.999
seroma	1	8	0.37 0.07 - 1.51	0.29 0.02 – 2.01	0.453
wound suppuration	2	9	0.62 0.17 – 1.68	0,53 0.11 – 2.13	0.734
intestinal obstruction	1	0	-	-	-
total	6	28	0.58 0.27 – 1.16	0.49 0.20 –1.26	0.153

*Only cases that required treatment in the operating room were recorded

reoperation is presented in *Table 2*. No case requiring early excision of the mesh was noted.

Postoperative drainage

Superficial drainage (subcutaneous and/ or retromuscular space) was used in 211 patients, with no statistically significant difference between the 2 groups concerning the number of drains: Group A – ranges 1-3, mean 1.7±0.7 versus group B – ranges 0-4, mean 1.6±0.6, p=0.756 (Mann Whitney test). The onlay group required a significantly longer period before removal of the drains (group A – ranges 3-15 days with a mean of 5,7±2,7 days versus group B – ranges 5-32 days with a mean of 16.6±5.2, p<0.0001 (Mann Whitney test) with a larger proportion of the patients who were discharged without removing the superficial drainage (group A 2/62 versus group B 141/168, p<0.0001 – Fisher's exact test).

Discussions

The current open repair of midline incisional hernia defects is based mainly on the onlay and sublay retromuscular repair using synthetic polypropylene meshes. Simple autologous repair (without meshes) is rarely performed, most often during emergency surgery for cases with acute complications leading to a significant bacterial contamination of the operative wound involving a high risk of mesh infection which is difficult to treat and involves a significant supplementary morbidity (6). The use of various laparoscopic approaches for incisional hernias has become popular during recent years, with good re-sults in selected cases. However, it requires significant experience, and its routine use is limited due to the higher costs resulting from the need to use special meshes and consumables (7-10). Properitoneal placement of meshes is frequently performed in laparoscopic inguinal hernia repairs, but it is rarely performed for midline incisional hernia defects. Both onlay and retromuscular sublay repair of midline incisional defects can be safely performed using simple and cheap polypropylene meshes while intraperitoneal placement requires the use of expensive coated meshes in order to avoid catastrophic complications (6). Our study did not include the patients with laparoscopic repairs since this approach requires different meshes and is typically used in more simple cases with smaller defects (10,11).

Both sublay and onlay placement of meshes have been reported with good results in large series. Each of them has advantages and disadvantages which are difficult to compare while the available data do not offer very strong evidence favoring one of the two techniques (4-6). The sublay repair involves a more delicate and time-consuming dissection, but it preserves a better blood supply of the

skin and al-lows the placement of the mesh in closed contact with a well-vascularized muscle which has been proved to be able to promote healing and fight against active infection in various clinical circumstances (12-15). The onlay placement is easier to perform, but damages the blood supply of the skin, and creates a superficial space that increases the chances for wound problems (seroma and skin necrosis with increased chances of mesh infection) and, very often, requires a prolonged drainage (16-18). Since one of the main subjects of debate between the two procedures is related to the incidence of various immediate postoperative complications, we focused on analyzing early outcome and morbidity.

The meshes used in our unit were placed more often onlay than sublay. A possible explanation is related to personal preference: since the sublay repair was introduced later, some of the surgeons are less experienced with the retromuscular dissection required by the sublay placement of the mesh and tend to use it in a more selective manner. The lack of a significant supplementary early morbidity in the sublay group may be a serious argument for using this technique more often.

Our analysis showed good immediate results with both sublay and onlay placement of the mesh. The overall zero mortality and the relatively low morbidity may be explained by the fact that this study included mostly scheduled operations in non-complicated cases. Cases of incisional hernias presenting with intestinal obstruction requiring intestinal resection are usually reconstructed without meshes due to the high risk of infection while very large defects are treated using intra-peritoneal substitution meshes (6). Our data showed a slightly increased incidence of post-operative hematoma and seroma in the onlay group, but without reaching a statistically significant value. The only significantly statistical difference found in this study was the need for a prolonged drainage of the subcutaneous space in the onlay group. A reduction of the incidence of seroma in hernia surgery is possible by using tissue sealants, but these products were not available in our unit. However, the statistical data about the postoperative morbidity should be interpreted with caution due to the relatively low incidence of the complications resulting in very small subgroups.

When interpreting our results we should take into consideration that they come from a retrospec-tive and non-randomised study. Another important factor is the relatively high number of surgeons in-volved with personal preference playing an important role in choosing the type of repair. We believe that the operative strategy should be adapted to the patient (anatomy of the defect and comorbidi-ties), especially in situations with an increased risk for developing postoperative complications. Another im-portant factor to take into consideration is represented by the lack of access to modern technologies such as adhesive glues or self-fixating meshes which have been shown to reduce the morbidity in her-nia repair (6,16) but their use was limited in our unit due to the significant supplemen-tary costs in-volved.

An important fact is the data from this study come from "the real world" – a 3 years' experience of a general surgery department in which incisional hernia repair is performed frequently, but is not the main area of interest. Our unit is not a dedicated hernia center while the financial constraints limit the use of both laparoscopy and other more expensive modern meshes and techniques reported by various centers with advanced expertise in hernia surgery (19,20). In the absence of clear data to favor a certain approach, we believe that general surgeons dealing with abdominal wall surgery should be familiar with all the available techniques, both open and minimally invasive. The operative technique should be adapted to the patient, experience of the operator with a certain technique, as well as to the local possibilities in terms of access to the newer technologies (21).

Conclusions

Both the sublay and onlay placement of the polypropylene mesh for the repair of ventral

incisional hernia offer good early results. Although more technically challenging, the sublay repair is not associated with a supplementary early morbidity while the onlay repair is associated with the need for a prolonged drainage of the subcutaneous space. Further studies are required for an adequate comparative evaluation of the two surgical techniques and to establish clear indications for each technique.

Author's Contributions

P.V.H. Boțianu: design, supervision, data analysis; F. Tutuianu: data analysis, literature review; C. Radoi, E. Ladanyi: data aquisition + analysis; A.M.V. Boțianu: literature review, supervision.

Conflicts of Interests

The authors declared no potential conflicts of interest.

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