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Review

Component separation technique for giant incisional hernia: A systematic review

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ABSTRACT

The component separation technique (CST) has gained popularity among general surgeons in the management of giant abdominal hernia.

A systematic review of the MedLine and EMBASE databases was performed. 36 observational cohort studies were included for data-analysis and divided in 4 main groups: Open Anterior Approach (OAA), Transversus Abdominis Release (TAR), Laparoscopic Anterior Approach (LAA) and Perforator Preserving Approach (PPA). Surgical Site Occurrences (SSO) occurred in 21.4%, 23.7%, 20.3% and 16.0% respectively. Incidence of recurrence was 11.9% (OAA), 5.25% (TAR), 7.02% (LAA) and 6.47% (PPA) with a significant difference in the advantage of TAR over OAA ($p < 0.001$).

Limitations in this systematic review were a lack of randomized trials, a heterogenous population and non-standardized methods for measuring outcomes, all making it difficult to postulate conclusions about CST and its modifications. Based on pooled results of 36 studies, the prevalence of SSO is comparable between the techniques with an average of one in five and the prevalence of recurrences is highest when using the Open Anterior Approach at 11.9%.

1. Introduction

Incisional hernias are one of the most common complications after abdominal surgery with an estimated incidence as high as 10–50% following midline laparotomy.[1,2] Hence it's not surprising that extensive research has been conducted in the prevention and management of this complication. A major improvement in hernia incidence was the development of the laparoscopic surgery where hernia incidence is on average 4.3% based on a meta-analysis of 3490 patients.[2] A challenging group of patients are those who have had multiple abdominal operations or recurrent wound herniation, maximizing the stress on their abdominal wall and making subsequent repairs more difficult. The 5-year reoperative rate in 10,822 Washington state patients who underwent incisional hernia repair was 23.8% after the first reoperation, 35.3% after the second, and 38.7% after the third.[3] These patients are at increased risk for hernia repair with loss of domain, hence not being able to achieve primary closure with standard procedures. Conventional methods such as primary open suture repair of ventral hernias with simple fascial approximation results in recurrence rates in excess of 60% in long-term follow-up[4,5] with the addition of mesh still resulting in long-term recurrence rates as high as 32%.[5] Hernias are thus not to be overlooked and are still a burden in all surgical disciplines. To address these issues, alternative surgical approaches have been developed.

This systematic review focuses on giant hernias and hernias with loss of domain which cannot be closed primarily without excessive tension and their management using the component separation technique. Due to their relative rarity there is no exact estimate of their incidence. Giant ventral hernias could be defined as ventral hernia larger than 10 cm in width with or without loss of domain.[6] In 1951 Albanese et al. designed a model of component separation of the abdominal wall, later elegantly refined by Ramirez et al. in 1990 as part of a study on human cadavers.[7,8] The latter's initial results showed the possibility of translating the abdominal midline on average 10 cm per side at the umbilical level when releasing the external oblique muscle, values reconfirmed in several following studies.[7–9] De Vries-Reilingh et al. showed the superiority of this technique when compared to mesh only.[5] Component separation has been applied increasingly and modifications trying to tackle the main issues of the technique have been made. Described limitations of this technique are complications

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Definitions and abbreviations

LAA	Laparoscopic/Endoscopic Anterior Approach
OAA	Open Anterior Approach
PPA	Perforator Preserving Approach, Open Anterior
QoL	Quality of Life
SSO	Surgical Site Occurrences
TAR	Transversus Abdominis Release

involving the skin and subcutaneous tissue, most likely caused by surgical interruption of perforating vessels during exposure of the oblique muscle.[10] To date, the more common variations on the component separation theme are the open anterior approach (OAA),[8] the transversus abdominis release (TAR),[11] the laparoscopic anterior approach (LAA)[12] and the open anterior perforator preserving approach (PPA)[13] with their original description in the noted references.

This systematic review analyzes the current literature involving component separation, its most common modifications and compares these techniques to evaluate if there are important differences in reported outcomes, adding evidence for best clinical practice.

2. Materials & methods

We performed a systematic review of the literature in the database of MedLine and EMBASE in search of articles which involved the component separation technique. Search terms used were: anterior component separation; posterior component separation; laparoscopic component separation; “components separation”; “separation of components”; “separation of parts”; external oblique release,; transverse abdominis release; abdominis muscle release; abdominal myofascial release; abdominis advancement flap; Ramirez technique. Language was limited to English, French, German or Dutch articles. The main author screened all databases on two separate occasions with a last review on 20/08/2016. This resulted in a total of 1329 records of which 36 were included after screening on basis of title and abstract (Fig. 1).

To achieve the greatest level of evidence our first search was aimed at randomized controlled clinical trials but these couldn't be retrieved based on our search. Therefore we focused on pro- and retrospective cohort studies for further evidence. Included articles had to involve component separation technique, in an elective setting, in any of the four common modifications: open anterior, laparoscopic anterior, transversus abdominis release or an open anterior perforator preserving approach and report at least one of our primary outcomes. All patient groups and all ages were considered, baring special attention to children included not having repair of omphalocoele or gastroschizis. When a study described a division of an included method (e.g. uni- or bilateral approach), or division based on patient characteristics (e.g. violated vs. non-violated rectus complex), weighted means of their outcomes were calculated.

Possible contamination or hernia incarceration were no reason for exclusion. We focused on incisional and not primary abdominal wall hernias with exclusion of inguinal and femoral hernias. Parastomal hernias were also excluded. All studies involving cadavers or animals were excluded from the results, but were allowed to be used for discussion purposes.

Our main primary outcomes considered were Surgical Site Occurrences (SSO) (pooled results of Surgical Site Infection (Deep/Superficial), abscess, skin necrosis, hematoma, wound dehiscence), recurrence rate (with follow-up) and quality of life (QoL). SSO had to be represented by a ratio or percentage and recurrences in the form of an incidence rate or a number/percentage and a mean (not median) follow-up period. Systemic complications and peroperative mortality were not included because of the unclear causality between the surgical technique and these complications and the latter's rarity and lack of reporting. Contamination was defined by the explicit statement of “contamination” and a percentage or ratio in the article or the sum of all percentages in the categories clean-contaminated or Grade II Hernia (as defined by Breuing et al.[14]) and above. We used the classification made by Muysoms et al. for mesh positioning.[15]

Because of the large discrepancies in study size, whenever means were calculated these were weighted for the number of patients. For both dichotomous variables (SSO, Hernia Recurrence) Pearson's Chi-Square test for an r x c table was used. When this revealed a significant result, further between group comparisons were performed using a post hoc Bonferroni correction ($\alpha = 0.008$). An estimated incidence rate per year was calculated with following formula: ($\sum$ Number of recurrences$_{\text{Per Study}}$/$\sum$ (Mean follow-up (year) x Number of patients)$_{\text{Per Study}}$). This gave an incidence rate that was weighted for both study size and follow-up period. Analysis of data was performed using IBM SPSS Statistics 24 and Microsoft Excel.

3. Results

Based on our search method and inclusion criteria 36 articles were obtained for data analysis. Of the included studies 22 concerned Open Anterior Approach (1348 cases, Fig. 2),[5,10,13,16–34] 8 Transversus Abdominis Release (761 cases, Fig. 3),[28,35–41] 13 Laparoscopic Anterior Approach (193 cases, Fig. 4)[10,12,21,23–25,29,30,32,42–45] and 5 Perforator Preserving Approach (242 cases, Fig. 5).[13,20,26,46,47] Study characteristics are summarized in Tables 1–4 respectively. The number of patients included in the studies ranged from [8-545] for OAA, [11-428] for TAR,[4–42] for LAA and [38-65] for PPA with the median patient number being 31, 46, 11 and 41 respectively. Average defect area when weighted by study size was 279, 540, 294 and 266 cm^2 based on 536, 634, 67 and 103 cases respectively. The number of contaminated procedures was 47% (252 cases) for OAA, 42% (605 cases) for TAR, 25% (146 cases) for LAA and 72% (136 cases) for the PPA group.

Regarding our primary outcome Surgical Site Occurrences (SSO), there was a large range from [0.0%–82.0%] over all included studies. The OAA showed an SSO in 21.4% ($283_{SSO}/1318_{Cases}$) of cases. This was 23.7% ($180_{SSO}/761_{Cases}$) for TAR, 20.3% ($39_{SSO}/193_{Cases}$) for LAA and 16.0% ($39_{SSO}/242_{Cases}$) for the PPA. Pearson Chi-square test for these former values showed no significant result ($p = 0.092$). When only including studies between the 25th and 75th percentile as a rough correction for outliers, the prevalence of SSO is 33.4% (OAA), 27.5% (TAR), 21.9%(LAA) and 19.0%(PPA).

Regarding recurrences, pooled analysis showed a total of 79 recurrences in the OAA group based on a total patient sample of 665 (11.9%) followed for 22 months on average. In the TAR 40 recurrences for 761 cases (5.3%) were seen over a mean follow-up time of 17 months. The LAA group presented with 12 recurrences in 171 cases (7.0%) over a mean follow-up time of 11 months. In the PPA group, 13 recurrences in 201 patients (6.5%) were observed over an average 22 months of follow-up. Pearson's Chi-Square test for the pooled results of recurrence prevalence shows $p < 0.001$, showing a significant difference in recurrences between the 4 methods when not corrected by length of follow-up. Separate Pearson Chi-Square results are presented in Table 5.

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