



# Short- and Long-Term Outcomes of Overlap Anal Sphincter Repair for Fecal Incontinence Following Sphincter Injury

## *Resultados em curto e longo prazos do reparo por sobreposição do esfíncter anal para incontinência fecal após lesão esfínteriana*

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### Abstract

**Objective** Several techniques are used to repair the anal sphincter following injury. The aim of the present study is to comprehensively analyze the short- and long-term outcomes of overlap repair following anal sphincter injury.

**Methods** A search was conducted in the PubMed, Medline, Embase, Scopus and Google Scholar databases between January 2000 and January 2020. Studies that described the outcomes that are specific to overlap sphincter repair for fecal incontinence with a minimum follow-up period of one year were selected.

**Results** A total of 22 studies described the outcomes of overlap sphincter repair. However, 14 studies included other surgical techniques in addition to overlap repair, and were excluded from the analysis. Finally, data from 8 studies including 429 repairs were analyzed. All studies used at least one objective instrument; however, there was significant heterogeneity among them. Most patients were female ( $n = 407$ ; 94.87%) and the mean age of the included individuals was 44.6 years. The majority of the procedures were performed due to obstetric injuries ( $n = 384$ ; 89.51%). The eight included studies described long-term outcomes, and seven of them demonstrated statistically significant improvements regarding the continence; one study described poor outcomes in terms of overall continence. The long-term scores were significantly better compared with the preoperative scores. However, compared with the short-term scores, a statistically significant deterioration was noted in the long-term.

**Conclusion** The majority of the studies described good long-term outcomes in terms of anal continence after overlap sphincter repair. However, further studies are needed

### Keywords

- ▶ overlap anal sphincter repair
- ▶ overlap repair
- ▶ outcome
- ▶ fecal incontinence
- ▶ anal incontinence
- ▶ sphincter injury

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to identify the factors associated with poor outcomes to assist in patient selection for overlap repair.

## Resumo

**Objetivo** Diversas técnicas são usadas no reparo do esfíncter anal após lesões. O objetivo deste estudo é fazer uma análise completa dos desfechos nos curto e longo prazos do reparo por sobreposição após lesão do esfíncter anal.

**Métodos** Realizou-se uma busca nas bases de dados PubMed, Medline, Embase, Scopus e Google Scholar entre janeiro de 2000 e janeiro de 2020. Estudos que descreviam desfechos específicos do reparo de esfíncter por sobreposição para incontinência fecal, com um mínimo de 1 ano de seguimento, foram selecionados.

**Resultados** No total, 22 estudos descreviam os desfechos do reparo de esfíncter por sobreposição. No entanto, 14 estudos incluíam outras técnicas cirúrgicas além do reparo por sobreposição, e foram excluídos da análise. Por fim, dados de 8 estudos que incluíam 429 reparos foram analisados. Todos os estudos usaram pelo menos um instrumento objetivo, mas havia uma heterogeneidade significativa entre eles. A maioria dos pacientes era do sexo feminino ( $n = 407$ ; 94,87%), e a idade média dos indivíduos incluídos foi de 44,6 anos. A maioria das cirurgias foi realizada devido a lesões obstétricas ( $n = 384$ ; 89,51%). Os oito estudos incluídos descreveram os desfechos no longo prazo, e sete deles demonstraram melhoras estatisticamente significativas com relação à continência; um estudo descreveu resultados ruins em termos gerais com relação à continência. As pontuações no longo prazo foram significativamente melhores em comparação com as pontuações no pré-operatório. No entanto, em comparação com as pontuações no curto prazo, percebeu-se uma piora estatisticamente significativa no longo prazo.

**Conclusão** A maioria dos estudos descrevia bons resultados no longo prazo em termos de continência anal depois do reparo do esfíncter por sobreposição. Entretanto mais estudos são necessários para que se identifiquem os fatores associados aos desfechos ruins para auxiliar na seleção de pacientes para o reparo por sobreposição.

## Palavras-chave

- ▶ reparo por sobreposição do esfíncter anal
- ▶ reparo por sobreposição
- ▶ desfecho
- ▶ incontinência fecal
- ▶ incontinência anal
- ▶ lesão esfínteriana

## Introduction

Fecal incontinence is defined as the involuntary evacuation of feces. It is a debilitating problem that causes physical, social and psychological impairments, with a considerable effect on the quality of life.<sup>1</sup> This condition affects 2% to 17% of the overall population, and almost half of all nursing home residents.<sup>2</sup> The etiology of fecal incontinence is multifactorial, and the most common factors are injury to the sphincter or neuronal damage associated with vaginal injuries, anorectal surgical procedures, and neurological conditions.<sup>3</sup>

The outcome following the repair of an anatomical defect of the anal sphincter depends on several factors, including the age of the patient, the cause of the injury, the length of time between the injury and the repair, and the type of repair.<sup>4,5</sup> Overlap and end-to-end are two widely-used techniques among several used to repair the anal sphincter following injury. The overlap repair is used for external anal sphincter defects, and it was described by Parks and McPartlin.<sup>6</sup> Several studies have assessed both the short- and long-term outcomes following overlap sphincteroplasty after various types of sphincter injuries using different tools to assess fecal incontinence.

The objective of the present review is to analyze the short- and long-term outcomes of overlap repair for patients presenting with fecal incontinence.

## Materials and Methods

A systematic review of the literature was performed including all observational and experimental studies on overlap sphincter repair, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The primary objective of the systematic review was to determine the short- and long-term outcomes and the success rates of the overlap sphincter repair. The secondary outcome was to identify the associated factors such as clinical and demographic parameters, and injury patterns in relation to the outcome.

## Search Strategy

We searched the PubMed, Medline, Google Scholar, Embase and Scopus databases for articles published between January 2000 and January 2020 using the search terms *anal sphincter* OR *fecal incontinence* OR *anal incontinence* AND *overlap repair* OR *overlap surgery* in the title or abstract fields.

A non-English language database known as APAMED Central was searched using the same criteria to reduce publication bias. The search was limited only to human studies. The reference list provided in full papers were also used to identify additional papers to be review. The last search date was January 31, 2020. Both experimental and observational studies that considered the outcome of overlap sphincter repair were included in the qualitative analysis.

The initial screening for eligibility was performed by two investigators based on the titles, abstracts, and keywords of the citations from the electronic databases. Thereafter, the full texts of all relevant records were assessed based on the inclusion criteria. In cases of doubt, the opinion of senior investigators was sought. Studies with elective surgical treatments with a minimum follow-up period of one year were defined as eligible. Studies including immediate primary repair

following injury were excluded, as the objective improvement in the sphincter function could not be assessed in them. Studies including other interventions in addition to overlap sphincter repair and those without objective assessment tools were excluded to minimize the bias and the confounding factors. The list eligible studies was then decided by consensus between two investigators.

Data from individual studies were tabulated, including study design, basic demographic and clinical parameters of the patients, injury pattern, timing of the surgery, preoperative investigations, postoperative short- and long-term outcomes, and complications. Finally, a qualitative analysis was performed with the available data. A meta-analysis could not be performed due to the heterogeneity in: the methodology of the studies, the treatment options, and the description of the outcomes. The assessment of the risk and bias of the eligible



### PRISMA Flow Diagram

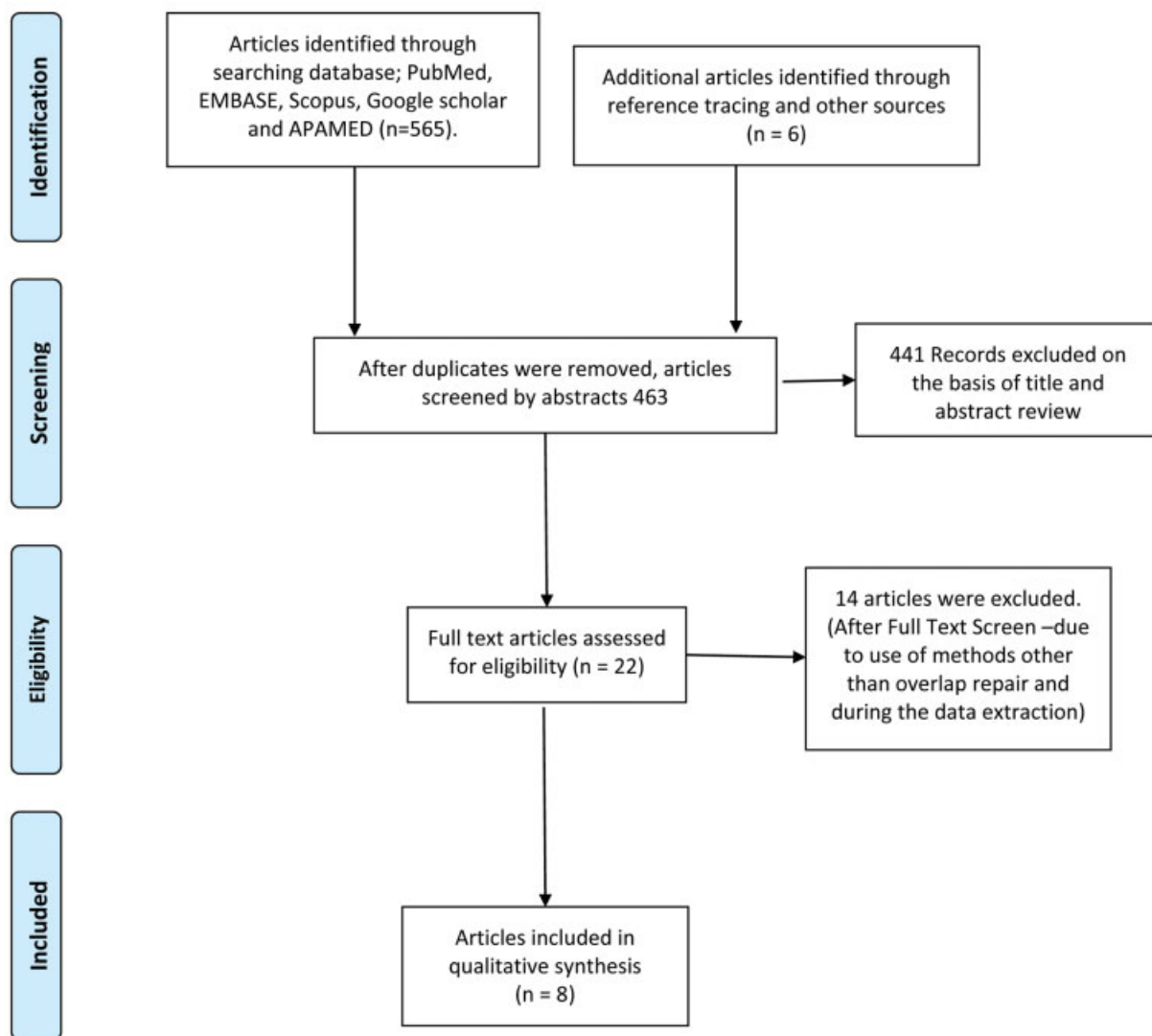


Fig. 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.

**Table 1** Summary of the findings of studies included in the systematic review

	Author	Location	Study design	N	Demographics	Injury pattern	Timing of the surgery	Preoperative investigations	Type of surgery	Short-term outcome (less than 1 year)	Long-term outcome (more than 1 year)
1	Maldonado et al., <sup>12</sup> 2019	United States	Retrospective study	29	All-female sample (mean age: 31.8 years)	fourth-degree lacerations (cloacal-like deformities)	Mean: 68.1 months	Presenting symptoms and physical examination	EAS OLR	NA	53.8% reported complete continence at a mean follow-up of 7.0 ± 3.6 years
2	Khafagy et al., <sup>9</sup> 2017	Egypt	Case-control study	Total 40 ORLs in 20 patients	M = 11 (55%); F = 9 (45%); mean age: 30.6 ± 17.5 years	anal fistula (n = 19; 47.5%); perineal trauma (n = 6; 15%); obstetric trauma – third degree perineal tear (n = 5; 12.5%); perianal necrotizing fasciitis (n = 5; 12.5%); hemorrhoidectomy (n = 3; 7.5%); stricturotomy for anal stenosis (n = 2; 5%)	1.01 ± 0.35 years	Wexner continence score, anorectal manometry, Endoanal US	EAS OLR +/-BMAC	6 months to 12 months; mean Wexner score changes from 7.7 to 7.4	NA
3	El-Gazzaz et al., <sup>11</sup> 2012	United States	Retrospective study	197	All-female sample; 146 (74.1%) patients in group A (< 60 years old); 51 (25.9%) patients in group B (> 60 years old); overall mean age at surgery: 50.4 years	obstetric injuries	NA	FIQI; FISI	EAS OLR	NA	The mean FISI score changed from 27.2 to 29.8 over an average of 7.7 years of follow-up
4	Zotshi et al., <sup>10</sup> 2009	United States	Prospective	N = 44 at the 5-year follow-up, and n = 31 at the 10-year follow-up	Median age at surgery: 5-year follow-up group - 38.5 years; 10-year follow-up group - 44 years	Obstetric trauma: 70.4%; iatrogenic: 15.9%; trauma: 6.8%; not reported: 6.8%	NA	FIQI; FISI; Bristol Stool Form Scale	EAS OLR	NA	Changes in scores from 5 years to 10 years of follow-up: a) mean patient-related FISI – from 21 to 39.39; b) mean surgeon-related FISI – from 20 to 39.97; c) mean FIQL – from 12 to 10.82
5	Dobben et al., <sup>8</sup> 2007	Netherlands	Prospective	30	97% of females; mean age: 50 Years (± 12 years)	Obstetric trauma: 97%	Median: 6.5years (0.5–22 years)	Vaizey incontinence score and Endoanal US, and MRI	EAS ORL	After surgery, the mean Vaizey score improved from 18 to 13 (p < 0.001)	NA
6	Barisic et al., <sup>7</sup> 2006	Serbia	Prospective	65	Females: 55 (84.61%); males: 10 (15.38%); mean age: 35.9 years (range: 18–64 years)	Obstetric trauma: 72.3%; fistulotomy: 13.8%; non-specific Trauma: 9.2%; war injury: 4.6%	Range: 0.5 to 20 years	Wexner score; Browning–Parks scale; anal Manometry; electromyography; defecography	EAS OLR	Wexner score improved from 17.8 preoperatively to 3.6 three months after the operation	Wexner deteriorated over time to 6.3 after an average of 80.1 months of follow-up
7	Tjandra et al., <sup>14</sup> 2003	Australia	Randomized controlled trial	Total 23; OLR -11 direct end-to-end repair -12	all female; DR 47y (32–71). OLR 45y (31–68);	Obstetric trauma	1 year	Endoanal US; anorectal manometry; neurophysiologic; Cleveland Clinic Continence Score	DR ; OLR	Mean Cleveland score changed from 17 to 3 postoperatively; maximum squeeze pressure changed from 80 mm Hg to 130 mm Hg postoperatively	Median follow-up of 18 months - improvement in continence scores (p < .05).

(Continued)

Table 1 (Continued)

Author	Location	Study design	N	Demographics	Injury pattern	Timing of the surgery	Preoperative investigations	Type of surgery	Short-term outcome (less than 1 year)	Long-term outcome (more than 1 year)
8 Malouf et al., <sup>9</sup> 2000	United Kingdom	Retrospective	38	All-female sample; mean age: 43 years (26–67 years)	Obstetric-related trauma	NA	Modified Park's continence scores; resting anal pressure; maximum squeeze anal pressure; sphincter length; pudendal nerve latencies; Endoanal US	OLR	NA	Outcome assessed at a median of 15 and 77 months; median Modified Park's score preoperatively: 4; 15 months post-operatively: 2; and 77 months postoperatively: 3

Abbreviations: BMAC, bone marrow aspirate concentrate; DR, direct repair; EAS OLR, external anal sphincter overlap repair; F, female; FIQL, Fecal Incontinence Quality of Life Scale; FISI, Fecal Incontinence Severity Index; M, male; MRI, magnetic resonance imaging; NA, not available; ORL, overlap repair; US, ultrasound.

studies was performed using standard risk-assessment tools. (► **Supplementary Table S1**)

**Results**

The initial search revealed 571 studies. After excluding the duplicates and the articles that were not relevant, a total of 22 studies describing the outcomes of overlap sphincter repair were selected (► **Fig. 1**). However, 14 studies used other surgical techniques in addition to overlap repair; therefore, they were excluded from the analysis. Data from 8 studies including 429 repairs were used in the final analysis; there were 4 prospective studies,<sup>7–10</sup> 3 retrospective studies,<sup>11–13</sup> and 1 randomized control trial.<sup>14</sup> The majority of the patients were female (n = 407; 94.87%), and the mean age of the included individuals was 44.6 years. The most common etiology for sphincter damage was obstetric injuries (n = 384; 89.51%). Every study used at least one validated tool for the pre- and postoperative assessment of the continence. In total, 5 studies<sup>8,9,12–14</sup> (n = 164; 38.22%) used endoanal ultrasound and/or manometry for the preoperative assessment. Only 2 studies<sup>9,14</sup> (n = 31; 7.22%) used endoanal ultrasound and/or manometry for the assessment postoperatively.

All included studies described long-term outcomes, and seven<sup>7–13</sup> of them described statistical significant improvements in the continence. However, 1 study<sup>14</sup> (n = 11; 2.56%) described a poor outcome in terms of overall continence. Two studies<sup>7,14</sup> mentioned both short- and long-term outcomes. The long-term scores were significantly better compared with the preoperative scores. However, compared with the short-term scores, a statistically significant deterioration was noted in the long-term (► **Table 1**).

**Discussion**

The objective of the present review was to analyze the short- and long-term outcomes of overlap anal sphincter repair for patients presenting with fecal incontinence. There was considerable heterogeneity in terms of study designs, pre- and postoperative assessment methods, and tools used for the assessment of the outcome. Most of the data available in the present systemic review came from prospective studies. ► **Table 2** shows the availability of information in the respective studies in relation to the objective of the study. In the present study, we were able to combine the relevant data regarding the overlap as the sole surgical technique. The continence was assessed through validated questionnaires and other assessment tools.

The present review included studies that analyzed anal sphincter injuries of different etiologies. However, most of the traumas were associated with obstetric injuries. Previous reviews<sup>15,16</sup> mainly analyzed only obstetric anal sphincter injuries. The study conducted by Khafagy et al.<sup>9</sup> has the most diverse etiologies, including anal fistula, perineal necrotizing fasciitis, trauma after hemorrhoidectomy, and injuries following stricturotomy for anal stenosis. As the etiology for the majority of the cases of anal sphincter injury was obstetric trauma in the present review, most patients included in the studies reviewed were female. Even though there are several

**Table 2** Availability of information in the studies included in relation to the objective of the systematic review

	Author	Objective preoperative assessment	Objective postoperative assessment	Short-term outcome	Long-term outcome	Tools
1	Maldonado et al. <sup>12</sup>	No	No	Yes	Yes	Fecal Incontinence Severity Index
2	Khafagy et al. <sup>9</sup>	Yes	Yes	No	Yes	Wexner Continence Score
3	El-Gazzaz et al. <sup>11</sup>	No	No	No	Yes	Fecal Incontinence Quality of Life Scale, Fecal Incontinence Severity Index
4	Zutshi et al. <sup>10</sup>	No	No	No	Yes	Fecal Incontinence Quality of Life Scale, Fecal Incontinence Severity Index, Bristol Stool Form Scale
5	Dobben et al. <sup>8</sup>	Yes	No	No	Yes	Vaizey Incontinence Score
6	Barisic et al. <sup>7</sup>	Yes	No	Yes	Yes	Wexner Score, Browning-Park's Scale
7	Tjandra et al. <sup>14</sup>	Yes	Yes	Yes	Yes	Cleveland Clinic Continence Score
8	Malouf et al. <sup>13</sup>	Yes	No	No	Yes	Modified Park's Scores

techniques for anal sphincter repair, the two mainly accepted techniques are end-to-end anastomosis and overlap sphincter repair.<sup>14</sup> A previous review<sup>17</sup> included studies using both methods of repair; therefore, the authors were unable to assess the outcomes of the individual techniques. In the present review, we considered the studies that used the overlap technique as the sole method of repair. A previous review<sup>18</sup> comparing the two techniques in patients with anal incontinence secondary to obstetric anal sphincter injuries concluded that there was no significant difference between them in terms of symptomatic outcomes after one year of follow-up. The studies included in the current review<sup>7</sup> had different objectives in terms of outcome.

The present study was limited by the heterogeneity of outcomes and the paucity of level-1 data precluding a meta-analysis. In the included studies,<sup>7</sup> the measurements used to assess the outcome were heterogeneous, with poor utilization of pre- and postoperative imaging modalities. Less than 50% of the patients underwent preoperative imaging exams to identify the sphincter defect. Less than 10% of the patients underwent postoperative imaging exams or physiological assessments. These findings reveal the need for proper pre- and postoperative assessments in future studies.

## Conclusion

Most of the included studies good long-term outcomes in terms of anal continence after overlap sphincter repair. However, further studies are needed to identify the factors associated with poor outcomes to assist in patient selection for overlap repair. In future researches, preoperative and postoperative assessments with imaging exams and physiology studies will be necessary.

### Declarations

Ethical approval and consent to participate: ethical approval and consent to participate are not applicable for this type of study.

### Availability of Data and Materials

The datasets generated and analyzed during the current study are included in the manuscript.

### Authors' Contributions

KL, OB and UJ formulated the concept and design of the study; designed the tables; collected, analyzed, and interpreted data; and wrote a draft of the article;. DNS contributed to the design and concept of the study, revising it critically for important intellectual content. All authors have read and approved the final version of the manuscript.

### Conflict of Interests

The authors have no conflict of interests to declare.

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