



# Documented Complications of Staple Hemorrhoidopexy: A Systematic Review

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A systematic review addressing reported complications of stapled hemorrhoidopexy was conducted. Articles were identified via searching OVID and MEDLINE between July 2011 and October 2013. Limitations were placed on the search criteria with articles published from 1998 to 2013 being included in this review. No language restrictions were placed on the search, however foreign language articles were not translated. Two reviewers independently screened the abstracts for relevance and their suitability for inclusion. Data extraction was conducted by both reviewers and entered and analyzed in Microsoft Excel. The search identified 784 articles and 78 of these were suitable for inclusion in the review. A total of 14,232 patients underwent a stapled hemorrhoidopexy in this review. Overall complication rates of stapled hemorrhoidopexy ranged from 3.3%–81% with 5 mortalities documented. Early and late complications were defined individually with overall data suggesting that early complications ranged from 2.3%–58.9% and late complications ranged from 2.5%–80%. Complications unique to the procedure were identified and rates recorded. Both early and late complications unique to stapled hemorrhoidopexy were identified and assessed.

*Key words:* Stapled anopexy – Stapled hemorrhoidectomy – Stapled hemorrhoidopexy – Complications

The stapled hemorrhoidopexy was introduced in 1993 and has been used as an alternative method to the Ferguson and Milligan-Morgan technique for the surgical management of hemorrhoidal disease. The technique has received enthusiasm as it was claimed that it could be completed with speed, minimal postoperative pain and good

postoperative outcomes, in comparison with the previously used methods. Despite this, however, long-term sequelae of the stapled hemorrhoidopexy have not been widely documented and recent evidence has led to suspicion surrounding the complication rates of the procedure and how these actually compare with other techniques of hemor-

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rhoidectomy. This review addressed and provided a review in regard to the complication rates of the stapled hemorrhoidopexy and has allowed for collation of data surrounding the major complications reported, within the literature, associated with this technique. It has allowed for a long-term collation of the complications associated with the procedures that have not been readily available and reported on, in the previously conducted randomized control trials (RCTs).

## Method

Articles were identified via searching OVID and MEDLINE, between July 2011 and October 2012. The search terms used were: “stapled anopexy complications,” “stapled hemorrhoidectomy,” “staple hemorrhoidectomy complications,” “stapled hemorrhoidopexy,” “stapled hemorrhoidoplexy complications,” and “Longo’s Procedure.”

Limitations were placed on the search criteria, with articles published from 1998 to 2012 being included in this review. No language restrictions were placed on the search; however, foreign language articles were not translated, thus only English articles were included. Additional articles were identified from the reference sections of all studies retrieved and reviewed for possible inclusion.

Two reviewers independently screened the abstracts for relevance and their suitability for inclusion was decided based on the information obtained and the availability of outcome data. Articles were included if sufficient data on complications of the procedure was available in the full text article. Data extraction was conducted by one reviewer and entered into a commercial spreadsheet program (Excel; Microsoft Corp., Redmond, WA) manually. Later, the data underwent a further check for accuracy, independently by the second reviewer.

## Results

The search identified 786 articles. Ninety-four articles were determined to meet the inclusion criteria and full text articles were obtained. Of the 94 identified, two articles were excluded as the full text was not able to be located electronically and a further 12 were not included as the full text article was in a foreign language.

Twenty-nine randomized control trials ( $n = 2294$ ,  $n = 1234$  SH) and 7 comparative studies ( $n = 1108$ ,  $n$

$= 869$  SH), 23 noncomparative studies ( $n = 12,115$ ) and 21 case reports ( $n = 27$ ) were included.

A total of 14,245 patients underwent a stapled hemorrhoidopexy in this review and the complications reported were interpreted. The largest study incorporated 7302 patients and the smallest, 18 patients (excluding case reports).<sup>1,2</sup> The age of the participants ranged from 17 to 92 years and all patients suffered from grade II to IV hemorrhoids.<sup>3,4</sup> Males and females were included in most studies; however, gender demographics were not always specified. Inclusion and exclusion criteria were documented in all articles reviewed. An outcome was considered to be a complication if it was not an expected result of the procedure and if it resulted in the patient experiencing discomfort or requiring further management. Complications were classified as being either early or late and were considered to be early if they occurred within 7 days of the operation. Those occurring after 7 days were considered to be late. Articles that did not specify a time in which the complications occurred have been considered to be early complications for the purpose of this review. Definitions of a complication were not always clearly provided and values reported were dependent on individual author reporting. Overall complication rates of the procedure ranged from 3.3 to 77%.<sup>5,6</sup>

## Early Complications

Overall early complication rates, demonstrated in Table 1, ranged between 2.3 and 52.5%, with the median complication rate being 16.1%, excluding pain.<sup>7,8</sup> Few complications were specific to stapled hemorrhoidopexy; however, these included failure of the stapling gun, urosepsis, and pelvic sepsis. The most common complication was early bleeding, with the overall rate following the procedure ranging from 0 to 68%.<sup>9</sup>

Sepsis was documented in 16 cases, all of which required rehospitalization, surgical re-intervention, and antibiotic therapy. All but 1 patient required a stoma.<sup>10</sup> Cases of pelvic sepsis and rectal perforation were documented, along with cases of Fournier gangrene, perforation, and sepsis; rectovaginal fistula with associated sepsis; a case of perforation and sepsis with rectopneumoperitoneum, pneumomediastinum, and rectal stricture; a case of perineal sepsis and synergistic gangrene; and a single case of perforation, obstruction, and sepsis were documented.<sup>11-16</sup>

Table 1 Early complication rates (RCT, case series, and case control)

Study	Bleeding, %	Urinary retention, %	TEH, %	Other	Incidence, %
Araujo <i>et al</i> <sup>65</sup>	11.80	7.90	5.30		
Basdanis <i>et al</i> <sup>64</sup>	20.00	14.00	–	Wound discharge	8.00
Bikhchandani <i>et al</i> <sup>46</sup>	2.40	11.90	–	Fever	2.40
				Incomplete doughnut	5.00
Boccasanta <i>et al</i> <sup>50</sup>	5.00	5.00	–	Pain	17.50
				Thrombosis and perianal ecchymosis	5.00
Brown <i>et al</i> <sup>58</sup>	60.00	–	–	Persistent prolapse	6.00
				Persisting pain	26.00
Cheetham <i>et al</i> <sup>65</sup>	13.00	–	–	Pain	13.00
Chen <i>et al</i> <sup>61</sup>	–	–	–	Fecal urgency	3.30
Chung <i>et al</i> <sup>66</sup>	2.30	6.90	4.60		
Correa-Rovelo <i>et al</i> <sup>18</sup>	2.40	2.40	–	Submucosal hematoma	2.40
Dixon <i>et al</i> <sup>67</sup>	1.60	1.60	–	Pain	3.20
Esser <i>et al</i> <sup>22</sup>	2.80	7.10	–	Urosepsis and rectal pain (urinary retention)	1.40
Finco <i>et al</i> <sup>57</sup>	11.20	13.80	–	Incomplete defecation	1.70
				Painful defecation	1.70
				Fecal urgency	5.20
Fondran <i>et al</i> <sup>17</sup>	1.20	4.90	2.40	Submucosal hematoma	2.40
				Fecal urgency	3.70
Ganio <i>et al</i> <sup>7</sup>	4.00	–	–		
Goldstein <i>et al</i> <sup>26**</sup>	21.70	3.30	3.30	Fecal impaction	2.00
				Fistula/abscess	1.30
Gravié <i>et al</i> <sup>68</sup>	1.90	1.90	12.70		
Hetzer <i>et al</i> <sup>69</sup>	10.00	–	–	Perianal thrombosis	5.00
Ho <i>et al</i> <sup>52</sup>	3.50	1.80	–		
Ho <i>et al</i> <sup>49</sup>	1.70	1.70	–		
Ho <i>et al</i> <sup>82</sup>	10.30	–	3.40		
Inoue <i>et al</i> <sup>19**</sup>	1.10	2.20	–	Pain needing analgesia	5.50
				Submucosal hematoma	2.20
Jongen <i>et al</i> <sup>25</sup>	4.00	6.40	0.60	Fecal impaction	2.80
				Fistula/abscess	1.40
Kairaluoma <i>et al</i> <sup>30</sup>	7.00	3.00	–	Fever	3.00
Kanellos <i>et al</i> <sup>34</sup>	–	5.80	–	Discomfort	8.30
				Rectal pain	5.80
Khalil <i>et al</i> <sup>70</sup>	–	2.30	–		
Khubchandani <i>et al</i> <sup>31</sup>	–	–	–	Postop burning	26.00
				Postop itching	17.70
Lai <i>et al</i> <sup>8</sup>	2.50	10.00	7.50	Fever	5.00
				Flap dehiscence	10.00
				Incomplete doughnut	10.00
				Fecal urgency	7.50
Lim <i>et al</i> <sup>4**</sup>	5.50	2.90	–	Pain	2.10
Mascagni <i>et al</i> <sup>54</sup>	4.50	–	1.50	Fissure	1.00
				Pain	6.00
				Soiling	1.00
Mattana <i>et al</i> <sup>9</sup>	68.00	–	–		
Mehigan <i>et al</i> <sup>71</sup>	–	5.00	–		
Nahas <i>et al</i> <sup>72</sup>	5.00	–	–	Pain	13.30
Nyström <sup>74</sup>	5.50	–	3.30		
Orrom <i>et al</i> <sup>2</sup>	11.00	0.00	5.00		
Ortiz <i>et al</i> <sup>6</sup>	–	22.00	3.00	Fecal impaction	3.00
				Passage of pus	3.00
				Wound dehiscence	3.00
Ortiz <i>et al</i> <sup>21</sup>	6.00	–	13.00	Fecal impaction	6.00
Oughriss <i>et al</i> <sup>23</sup>	1.80	0.72	–	Constipation → Fecaloma	0.36
				Defective stapling	0.36
				Fecal incontinence	0.18
				Fistula/abscess	0.54
				Rapidly expanding hematoma severe pain	0.18
				Suppurations	0.50

Table 1 Continued

Study	Bleeding, %	Urinary retention, %	TEH, %	Other	Incidence, %
Palimento <i>et al</i> <sup>145</sup>	5.40	13.50	–		
Pavlidis <i>et al</i> <sup>29</sup>	7.50	–	–		
Peng <i>et al</i> <sup>56</sup>	6.60	3.30	–		
Pernice <i>et al</i> <sup>28</sup>	1.70	13.00	–	Edema of anastomotic ring	7.10
Plocek <i>et al</i> <sup>75</sup>	2.60	–	–	Fecal impaction	1.30
				Pain	4.00
				Seepage	1.30
				Subcutaneous emphysema	1.30
Racalbuto <i>et al</i> <sup>20</sup>	6.00	2.00	–	Congestion and perianal edema	20.00
				Hematoma under mucosa	2.00
				Fecal urgency	8.00
Ravo <i>et al</i> <sup>3</sup>	4.20	1.50	2.30	Dehiscence	0.50
				Fissure	0.20
				Fistula/abscess	0.10
				Perineal intramural hematoma	0.10
				Severe pain	5.00
Senagore <i>et al</i> <sup>24</sup>	9.10	13.00	–	Constipation	6.50
				Transient fecal incontinence	3.90
Shalaby <i>et al</i> <sup>76</sup>	1.00	7.00	3.00	Early fissure	1.00
Sobrado <i>et al</i> <sup>27</sup>	10.30	3.90	1.30	Failure of stapler	0.60
				Fecal impaction	1.90
				Fever	1.90
				Pain	23.80
Stolfi <i>et al</i> <sup>77</sup>	3.10	3.10	–	Fecal urgency	5.30
Touzin <i>et al</i> <sup>78</sup>	5.00	2.50	–	Pain	0.00
Uras <i>et al</i> <sup>5</sup>	1.00	8.00	–	Fecal urgency	25
Zacharakis <i>et al</i> <sup>32</sup>		12.50	–	Discomfort	37.50
				Pain	10.70

Submucosal hematomas were also reported in 6 cases and a single case of perineal intramural hematoma was reported.<sup>3,17–20</sup> Early thrombosed external hemorrhoids (TEH) were also reported, with the overall early occurrence rate ranging from 0 to 13% and a median occurrence of 4.51%.<sup>21</sup>

Overall rates of urinary retention ranged from 0 to 22%.<sup>6</sup> Few articles documented whether or not urinary catheterization was required to treat the retention. Cases of urosepsis were also seen concomitantly in a small number of patients with urinary retention.<sup>22</sup>

Early fecal urgency was reported and reported rates ranged from 0 to 25%, with a median occurrence of 8.28%.<sup>5</sup> Early constipation was also reported in 5 patients (0.03%) and in 2 cases, a fecaloma resulted (0.014%).<sup>23,24</sup> Fecal incontinence was seen more commonly as a late complication; however, it was also reported as an early occurrence and not all articles reported whether or not the incontinence persisted.<sup>23,24</sup> Fecal impaction was also reported.<sup>6,21,25,26,27</sup> Early complications including anastomotic dehiscence and edema of the anastomotic ring were also reported.<sup>3,8,20,28</sup>

## Late Complications

Late complications were those occurring postoperatively after 7 days, listed in Table 2. Patient follow-up ranged from 1 month to 7 years.<sup>1</sup> Not all articles that described early complications with staple hemorrhoidopexy reported late complications and vice versa. Overall late complication rates, excluding skin tags and recurrence, ranged between 2.5 to 80%, with a median value of 23.7%.<sup>29,30</sup>

Bleeding was again commonly reported, with the overall rate of late bleeding determined to range from 0.18 to 33%.<sup>23,30</sup> Bleeding with defecation was commonly reported as the cause of late bleeding and late onset frank hemorrhage, although this was less common. TEH were reported both before and after 7 days, with a median of 1.5% occurrence and overall rates of occurrence ranging from 0.3 to 4%.<sup>25,28</sup>

Anal strictures and stenosis incidence ranged from 0 to 15.6%.<sup>31</sup> Incontinence to feces and/or flatus was reported, with the overall range of occurrence between 0.1 to 17.8%. However, whether this complication was transient or permanent was

Table 2 Late complication rates (RCT, case control, and case series)

Study	Pain, %	Incontinence fecal/flatulency, %	Urgency, %	Anal stenosis, %	Fissure, %	Recurrence, %	Skin tags, %	Other	Incidence, %
Araujo <i>et al</i> <sup>63</sup>	-	-	3.60	-	5.30	-	5.40	Bleeding Prolapse Tenesmus	1.80 5.40 3.60
Basdanis <i>et al</i> <sup>64</sup>	-	2.00	-	-	-	6.00	-	Pruritus	4.00
Bikhchandani <i>et al</i> <sup>46</sup>	-	7.10	-	-	-	9.50	9.50	Mucus discharge Increased stool frequency	2.40 5.00
Boccasanta <i>et al</i> <sup>50</sup>	-	-	-	-	-	-	2.50	Soiling Dehiscence	2.50 5.00
Brown <i>et al</i> <sup>58</sup>	-	-	-	7.00	7.00	-	-	Bleeding Discharge	20.00 7.00
Cheetham <i>et al</i> <sup>65</sup>	-	-	13.00	-	6.00	20.00	-	Discomfort Prolapse Bleeding	5.00 13.00 27.00
Chen <i>et al</i> <sup>61</sup>	-	-	-	-	-	-	-	-	-
Chung <i>et al</i> <sup>66</sup>	-	4.60	-	-	-	4.60	-	-	-
Correa-Rovelo <i>et al</i> <sup>18</sup>	4.90	2.40	-	2.40	-	2.40	7.30	Bleeding Dyspareunia Pruritus ani	33.60 2.40 2.40
Dixon <i>et al</i> <sup>67</sup>	-	-	-	-	-	-	-	Bleeding	1.60
Esser <i>et al</i> <sup>22</sup>	-	4.00	-	-	-	-	-	Manual disimpaction	1.00
Finco <i>et al</i> <sup>57</sup>	-	3.40	5.20	-	3.40	9.50	-	Pruritus ani Bleeding	0.80 1.70
Fondran <i>et al</i> <sup>17</sup>	-	-	-	-	-	2.40	-	Bleeding Inflammatory polyps Staple line cyst	10.00 11.00 1.20
Ganio <i>et al</i> <sup>79</sup>	-	0.00	-	-	-	-	-	Prolapse Bleeding	16.00 28.00
Ganio <i>et al</i> <sup>7</sup>	-	20.00	13.00	2.00	2.00	13.00	-	Sensation of incomplete evacuation	2.00
Goldstein <i>et al</i> <sup>26</sup>	-	-	-	0.66	0.66	1.90	-	-	-
Gravié <i>et al</i> <sup>68</sup>	-	11.50	-	-	3.80	7.50	-	Fecaloma	1.90
Grigoropoulos <i>et al</i> <sup>80</sup>	-	-	6.50	-	-	-	-	-	-
Hetzer <i>et al</i> <sup>69</sup>	-	-	-	-	-	5.00	-	-	-
Ho <i>et al</i> <sup>52</sup>	-	3.20	-	8.80	-	-	19.30	Bleeding Pruritus Wound discharge Fecal impaction	33.30 15.80 8.80 8.80
Ho <i>et al</i> <sup>49</sup>	-	-	-	2.60	-	-	32.10	Minor bleeding Fecal impaction Sphincter deficits (dilator) Pruritus, 2 wks Pruritus, 14 wks Anal discharge, 2 wks Anal discharge, 14 wks	27.50 3.40 13.70 32.00 20.00 13.00 3.40
Ho <i>et al</i> <sup>82</sup>	-	13.40	-	-	-	-	13.80	Minor bleeding Wound discharge Wound pruritus Incomplete wound healing Urinary incontinence	13.80 13.80 24.10 3.40 3.40
Inoue <i>et al</i> <sup>19</sup>	-	-	-	-	7.80	4.40	-	-	-

Table 2 Continued

Study	Pain, %	Incontinence fecal/flatul, %	Urgency, %	Anal stenosis, %	Fissure, %	Recurrence, %	Skin tags, %	Other	Incidence, %
Jongen <i>et al</i> <sup>25</sup>	–	1.50	–	–	0.90	–	1.50	TEH	0.30
								Submucosal anastomotic cyst	0.60
								Proctitis	0.30
								Persistence of prolapse	0.50
								Reoperation rate	3.40
								Dehiscence	3.20
Kairaluoma <i>et al</i> <sup>30</sup>	–	–	6.00	–	–	40.00	40.00	Anastomotic stenosis	
								Bleeding	35.00
								Failure	23.00
								Soiling	14.00
Kam <i>et al</i> <sup>1</sup>	–	–	–	1.20	–	0.20	–	Abscess	0.02
								Severe prolonged pain	2.00
								Pruritus	3.00
								Dehiscence	0.04
Kanellos <i>et al</i> <sup>34</sup>	–	5.80	13.30	–	–	6.60	–	Soiling	0.83
Khalil <i>et al</i> <sup>70</sup>	–	10.00	–	–	4.00	–	–		
Khubchandani <i>et al</i> <sup>31</sup>	17.50	–	–	15.6	–	–	49.70	–	–
Lai <i>et al</i> <sup>8</sup>	–	–	5.00	2.50	–	5.00	7.50	Hypertrophy papillae	5.00
Lim <i>et al</i> <sup>4</sup>	7.00	–	–	0.80	0.04	–	5.50	Mucous discharge	1.26
								Anal pruritus	2.10
								Slight bleeding	6.00
								Difficult evacuation	4.00
Mascagni <i>et al</i> <sup>54</sup>	2.50	–	0.50	–	–	2.50	3.00	Bleeding	3.50
								TEH	1.50
								Sphincter spasm	0.50
Mattana <i>et al</i> <sup>9</sup>	–	6.00	–	–	–	22.00	–	Pruritus	4.00
								Bleeding	14.00
								Tenesmus	32.00
								Soiling	4.00
Mehigan <i>et al</i> <sup>71</sup>	5.00	5.00	10.00	–	5.00	–	20.00	Bleeding	5.00
Nahas <i>et al</i> <sup>72</sup>	2.00	–	1.00	2.00	1.00	5.00	–	Perianal thrombosis	2.00
Naldini <sup>73</sup>	–	–	–	–	–	–	–	Stable hematoma	2.40
								Active hematoma	1.00
								Sepsis/perineal necrosis	0.50
Nyström <sup>74</sup>	2.20	15.50	–	1.10	1.10	–	43.00	–	–
Orrom <i>et al</i> <sup>2</sup>	–	–	–	5.00	–	–	–	Bleeding	10.00
Ortiz <i>et al</i> <sup>6</sup>	3.00	–	7.00	–	–	–	26.00	Prolapse	26.00
								Bleeding	7.00
								Itch	11.00
Ortiz <i>et al</i> <sup>21</sup>	–	–	13.00	–	–	–	66.00	Bleeding	6.00
								Prolapse	53.00
								Itching	40.00
								Tenesmus	40.00
Oughriss <i>et al</i> <sup>23</sup>	–	0.36	–	1.60	0.90	3.20	–	Anal fistulization	0.54
								Bleeding	0.18
								Dyspareunia	0.36
								Intramural rectal abscess	0.54
								Pain	1.60
								Suture dehiscence	1.60
								TEH	0.90
								Urgency	0.36
								Dehiscence	1.60
Palimento <i>et al</i> <sup>45</sup>	16.20	–	–	–	–	–	–	Bleeding	21.60

Table 2 Continued

Study	Pain, %	Incontinence fecal/flatus, %	Urgency, %	Anal stenosis, %	Fissure, %	Recurrence, %	Skin tags, %	Other	Incidence, %
Pavlidis <i>et al</i> <sup>29</sup>	–	2.00	–	–	–	–	–	–	–
Peng <i>et al</i> <sup>56</sup>	–	6.60	–	–	–	–	–	Bleeding	26.00
								Prolapse	23.00
								Pruritus Ani	17.00
								Dehiscence	10.00
Pernice <i>et al</i> <sup>28</sup>	–	–	–	–	–	–	–	Bleeding	17.00
								Painful defecation	1.70
								Wound edema and pain	1.70
								Post-defecation	5.30
Plocek <i>et al</i> <sup>75</sup>	–	–	–	–	4.00	4.00	–	–	–
Racalbuto <i>et al</i> <sup>20</sup>	–	6.00	6.00	–	6.00	4.00	–	Outlet obstruction	6.00
								Bleeding	6.00
Ravo <i>et al</i> <sup>3</sup>	1.70	0.2	0.20	–	0.60	–	0.50	Bleeding	0.50
								Intramural abscess	<0.10
								Intussusception	<0.10
								Papillary hypertrophy	0.30
								TEH	0.40
Riaz <i>et al</i> <sup>81</sup>	1.51	–	15.8	1.51	–	4.54	–	Perianal hematoma	1.51
Senagore <i>et al</i> <sup>60</sup>	2.60	–	–	2.60	–	–	–2.60	Perianal itch	3.90
								Perianal burning	1.30
								Perianal inflammation	1.30
								Urinary incontinence	2.60
Shalaby <i>et al</i> <sup>76</sup>	–	–	–	2.00	2.00	–	4.00	Prolapse	1.00
								Discharge	2.00
Sobrado <i>et al</i> <sup>27</sup>	–	1.90	–	–	–	1.30	–	Tenesmus	3.90
								Mucous Prolapse	3.20
								Bleeding	10.30
Stolfi <i>et al</i> <sup>77</sup>	–	–	–	2.10	6.30	7.40	14.8	–	–
Touzin <i>et al</i> <sup>78</sup>	5.00	5.00	–	–	–	–	–	Hemorrhage	2.50
Uras <i>et al</i> <sup>5</sup>	–	–	–	2.00	1.00	–	3.00	Pruritus ani	25.00
								TEH	4.00
Zacharakis <i>et al</i> <sup>32</sup>	–	17.80	25.00	–	–	58.90	–	Soiling	3.30

often not always specified.<sup>8</sup> Fecal urgency was also noted with an incidence range of 0.2 to 25% of cases.<sup>3,32</sup> A sensation of painful, incomplete, or difficult evacuation was also commonly reported following stapled hemorrhoidectomy.<sup>4,28</sup>

Pruritus ani, anal fissures, and skin tags were commonly reported, as was mucosal prolapse. Proctitis was a unique late complication reported.<sup>25</sup> Tenesmus was more commonly reported in stapled hemorrhoidectomy than other methods of hemorrhoidectomy and occurrence rates ranged from 0 to 40%.<sup>21</sup> Intramural fistulization was reported in 0.02% of cases, all were on the staple line and required clearance and elastic drainage for management.<sup>23</sup> Submucosal anastomotic cysts were reported.<sup>17,25</sup> Recurrence of hemorrhoids following the procedure occurred up to 58.9% of patients.<sup>32</sup>

## Discussion

The randomized control trials available for review were often limited by small sample sizes and short follow-up times. All of the RCTs were conducted between 2001 and 2011. It was identified that there was variation among studies in the methods, inclusion, and exclusion criteria of the studies, and notable differences between patient demographics, equipment used, postoperative care regimes, and overall outcome measures and documentation. Follow-up times were also inconsistent between the studies and comparability between the studies is difficult due to obvious heterogeneity. It is important that these factors are considered when interpreting the results.

Overall early and late complication rates of stapled hemorrhoidectomy have been said to be

similar to those seen with that of a conventional excisional hemorrhoidectomy, with some articles even demonstrating a lower complication rate in stapled hemorrhoidopexy than other methods.<sup>78,79</sup> Although the complications associated with this procedure are often minor, there have been many documented cases of severe and major complications secondary to this procedure.

Postoperative bleeding was the most commonly reported complication; however, these rates were lower when compared with other methods of hemorrhoidectomy.<sup>47,56</sup> Bleeding following stapled hemorrhoidopexy is said to most commonly occur immediately after surgery or from day 7 onwards. It has been suggested that bleeding often occurs secondary to an arteriolar bleed along the staple line, from defective techniques that result in injury to the mucosa and may also be secondary to inflammation and/or rejection of the staples when the procedure is completed during a period of anusitis.<sup>23</sup> To minimize a patient's risk of bleeding, manual oversewing of the staple line, use of a stapling gun with a smaller staple height closure, and the use of a postoperative endoanal sponge has been suggested.<sup>48</sup> Multiple interventions for cessation of postoperative and late bleeding have been reported, including Foley catheter compression, suturing, the use of mesh, and injection of adrenaline. In a number of cases, blood transfusion was needed in order to restore hemoglobin levels.<sup>3,8,23,49,50</sup> The incidence of early bleeding was greatly reduced following the introduction of the second wave of stapling instruments (PPH01 to PPH03). The introduction of this new instrument resulted in a smaller staple width, which also reduced the necessity for oversewing of the staple line.

TEH were reported as both an early and late complication of stapled hemorrhoidectomy. Suggested causes of thrombosed external hemorrhoids included the lack of removal of the hemorrhoidal sinuses in the procedure and the subsequent progression of the nonresected hemorrhoidal sinusoids, or secondary to the sinusoids being traumatized during the procedure.<sup>3</sup> It was also suggested that the distance of the staple line from the anal verge may be a contributing factor to the development of thrombosed external hemorrhoids along with the significance of external disease.<sup>23</sup> Management options included conservative management (sitz baths) and surgical excision.<sup>51</sup> Other articles have also suggested the avoidance of constipation via the regular use of lactulose.<sup>25</sup>

Multiple cases of sepsis have been documented following stapled hemorrhoidopexy, with most

cases requiring rehospitalization, surgical re-intervention, and antibiotic therapy. It has been reported that mortality associated with severe sepsis following staple hemorrhoidopexy is 10%.<sup>84</sup> This article identified four cases of death following stapled hemorrhoidopexy and all were associated with rectal perforation and sepsis, as seen in Table 3.<sup>11,83</sup> Rectal perforation with associated peritonitis has also been identified as a unique complication in staple hemorrhoidopexy.<sup>83,84</sup>

All cases of sepsis noted in the case reports for this review were treated surgically, with all requiring either an anterior resection, loop ileostomy, or end colostomy.<sup>83</sup> Other authors have placed emphasis on the depth and placement of the purse-string suture, in order to avoid excess muscle incorporation in the doughnut and prevention of the introduction of bacteria into the perianal tissues.<sup>44,83</sup> The introduction of bacteria has also been attributed to anastomotic dehiscence, malfunctioning staplers, surgical inexperience, and double firing of the stapler.<sup>83</sup> Articles have also suggested the use of prophylactic antibiotics in patients undergoing stapled hemorrhoidopexy.<sup>45</sup> It has recently also been reported that the complications associated with sepsis following staple hemorrhoidopexy appear to be more frequent than that of all other techniques used to treat hemorrhoids.<sup>84</sup>

Defective stapling is a unique risk associated with stapled hemorrhoidopexy that has been shown most often to occur secondary to technical errors or problems with materials. Complications including anastomotic dehiscence have been reported secondary to the use of a defective stapler, along with incomplete stapling.<sup>8,23,27,46</sup> Routine checking of the staplers prior to the commencement of surgery has been recommended.<sup>8,23</sup>

Tenesmus was more commonly reported in stapled hemorrhoidopexy and authors have attributed this to the presence of a low rectal suture.<sup>21</sup> Intramural fistulization was reported in 0.02% of cases, all on the staple line, and required clearance and elastic drainage for management.<sup>23</sup> Submucosal anastomotic cysts were reported postoperatively and these were associated with the retention of fecolith material at the anastomotic level.<sup>25</sup> It is also proposed that the stapler can create a space that incorporates mucosally lined tissue; that often requires time to accumulate mucus and for the patient to become symptomatic.<sup>25</sup> Submucosal anastomotic cysts required resection. Dyspareunia were reported that lasted longer than 2 months; however, authors failed to specify whether sexual practices



Table 3 Case reports

Study	Complication	Treatment	Death, n
Aumann <i>et al</i> <sup>37</sup>	Intra-abdominal hemorrhage	Colostomy	
Blouhos <i>et al</i> <sup>33</sup>	Hemoperitoneum	Laparotomy for anterior resection	
Büyükasik <i>et al</i> <sup>39</sup>	Rectal obliteration	Removal of anal staples Use of manual sutures to repair	
Ciprani <i>et al</i> <sup>40</sup>	Tenesmus Mucus soiling Rectal bleeding Rectal obstruction Rectal stricture	Stricture release	
Cirroco <sup>11</sup>	Intestinal obstruction and perforation Sepsis Air retroperitoneum Multi-organ failure Rectal obstruction and perforation	Hartmann's procedure  Abdominal exploration Loop ileostomy	1
Del Castillo <i>et al</i> <sup>36</sup>	Perforation	Repair and colostomy Surgical exploration	
Filingeri (2005) <sup>85</sup>	Rectal perforation	Sutured perforation closed via transanal route	
Gao <i>et al</i> <sup>83</sup>	Passage of fluid per rectum Staple line dehiscence Rectal perforation Rectal perforation Fever Peritonitis Rectal perforation Abdominal pain and distension Peritonitis Pain, fever Rectal perforation Pain, distension Fever Pain, distension Fever Pain, distension Fever	None  Perforation repair Terminal ileostomy  Perforation repair Transverse colostomy Perforation repair Colostomy Pelvic drainage Perforation repair Transverse colostomy Perforation repair Sigmoid colostomy Exploratory laparotomy	1
Giordano <i>et al</i> <sup>41</sup>	Rectal obliteration	Flexible sigmoidoscopy Gastrografin enema Dilatation	
Herold (2000) <sup>86</sup>	Rectal perforation Rectal perforation Rectal perforation Rectal perforation	Temporary stoma Temporary stoma Permanent stoma N/A	1
Kanellos <i>et al</i> <sup>34</sup>	Pneumomediastinum Retropneumoperitoneum Subcutaneous emphysema Perianal abscess Staple line stenosis	Proctoscopic dilation Conservative management	
Kekez <i>et al</i> <sup>43</sup>	Dyspareunia (anal intercourse) Damage to condom	Refrain from anal intercourse for 3 months	
Maw <i>et al</i> <sup>10</sup>	Retroperitoneal sepsis Retroperitoneal gas	Conservative management – IV antibiotics	
McCloud <i>et al</i> <sup>16</sup>	Perineal sepsis Synergistic gangrene	Loop colostomy IV antibiotics	
McDonald <i>et al</i> <sup>42</sup>	Rectovaginal fistula	Vaginal repair Loop ileostomy	
Molloy <i>et al</i> <sup>15</sup>	Retroperitoneal sepsis Retroperitoneal gas	End colostomy Drainage	
Pessaux <i>et al</i> <sup>13</sup>	Fournier gangrene Perforation sepsis	End colostomy Debridement	

Table 3 Continued

Study	Complication	Treatment	Death, n
Ripetti <i>et al</i> <sup>14</sup>	Perforation Sepsis Rectopneumoperitoneum Pneumomediastinum Rectal stricture	Double-barreled colostomy Conservative management	
Roos <sup>35</sup>	Rectovaginal fistula Sepsis	Colostomy Debridement	
van Wensen <i>et al</i> <sup>12</sup>	Pelvic sepsis Rectal perforation Pre-sacral fluid	Laparotomy Loop ileostomy	
Wong <i>et al</i> <sup>38</sup>	Retroperitoneal gas Rectal perforation Fecal peritonitis Prolonged ileus	Rectal transection Peritoneal lavage End colostomy	

were conventional.<sup>23</sup> Anal intercourse following stapled hemorrhoidopexy has also been suggested to increase the risk of penile injury and condom damage during anal intercourse, secondary to the placement of the circular line of staples.<sup>43</sup> It is thought that this could also increase the risk of patient exposure to sexually transmitted diseases.<sup>43</sup>

Pruritis ani, anal fissures, and skin tags were commonly reported, as was mucosal prolapse. It is proposed that anal fissures occur secondary to the inclusion of excessive mucosal folds in the staple line.<sup>3</sup> As a result, the mucosal fold can breakdown and allow for the development of a fissure that will often not heal unless the staples are removed.<sup>3</sup> Proctitis was a late complication unique to stapled hemorrhoidopexy and was thought to be secondary to ischemia.<sup>25,51</sup>

The recorded rates of incontinence to feces and or flatus were similar to those of other methods of hemorrhoidectomy. No difference was identified between continence scores, anorectal manometric scores, and endoanal ultrasonographic findings between stapled hemorrhoidectomy and other techniques.<sup>54</sup> It was proposed that the incontinence may be secondary to the use of anal dilator devices or stretching of the anal canal during insertion or firing of the stapler and that their use can lead to internal sphincter fragmentation, if excessive or prolonged.<sup>5,54,55</sup> The judicious careful use of an Eisenhammer retractor for purse string suture insertion has been shown to reduce the incidence of these complications.<sup>56,57</sup>

Soiling and mucus discharge was also documented.<sup>4,9,30,32,46</sup> Fecal urgency was also noted with an incidence range of 0.2 to 25% of cases. It is postulated that excessive anal dilation can also

contribute to its development, as well as the presence of submucosa and muscularis mucosa in the resected tissue and anastomotic denervation secondary to pelvic dissection and removal of proximal rectum and mesorectum.<sup>55</sup> The use of transanal electrostimulation and agraffectomy has been suggested as treatment for these conditions, although the benefits have not been extensively documented.<sup>48</sup> It is suggested that stapled hemorrhoidectomy should be avoided in patients with reduced rectal compliance or those who have hypersensitivity of the rectum which has been assessed via anorectal testing.<sup>48</sup>

Risk factors for the development of strictures include higher-grade hemorrhoidal disease, residual sphincter hypertonia, and the presence of muscle fibers in resected tissue.<sup>5,23</sup> Most cases are successfully managed via digital dilatation in clinic. However, if the dilatation is unsuccessful, anoplasty is also a commonly reported secondary intervention.<sup>3,5,23,58</sup> Few authors reported medical management with laxatives and fiber supplementation.

Recurrence of hemorrhoids following the procedure occurred in individual studies, in up to 58.9% of patients, with a median recurrence rate of 6.9% being documented. The rate of residual skin tags and recurrence has been shown to be considerably higher than other methods of hemorrhoidectomy, but in line with the rates seen in rubber band ligation.<sup>44,56,59</sup> Residual skin tags have been suggested to shrink in size following stapled hemorrhoidopexy, although many studies do not support this finding.<sup>46,60</sup> It has been suggested that via the use of a purse-string suture approximately 2.5 cm above the dentate line, it is possible to lift both the prolapsed internal hemorrhoids and also the exter-

nal components, bringing them closer to the normal anatomical position.<sup>61</sup> Excision of residual perianal skin tags is also practiced, but may possibly result in increased postoperative discomfort.

A number of factors were identified that influence recurrence rates, and rates of recurrence were shown to be higher in patients with grade four hemorrhoidal disease.<sup>32</sup> Articles also suggested that recurrence rates following stapled hemorrhoidopexy in 4th degree hemorrhoids can be up to 22%, in comparison to those of 3.6% in conventional hemorrhoidectomies.<sup>53</sup> It is thought that this is secondary to the irreducibility of the prolapse precluding the lifting effect of the stapled hemorrhoidopexy.<sup>32,57</sup> Technical characteristics of the procedure have also been shown to be implicated in the development of recurrent hemorrhoids, including the placement of the purse string, the level of the staple line, and the completeness of the mucosectomy ring.<sup>53</sup> It was identified that patients who have recurrence following stapled hemorrhoidopexy were more likely to undergo re-interventional treatments, such as excisional hemorrhoidectomies, than patients who have initially undergone other methods of hemorrhoidectomy.<sup>32</sup> Common reasons for re-intervention include persistent pain, postoperative bleeding secondary to recurrent piles, retained staples, and anal fissures.<sup>51</sup>

There was a lower incidence rate of postoperative pain in stapled hemorrhoidopexy, than other methods of hemorrhoidectomy. In addition, the procedure was also identified to be associated with a shorter duration and reduced severity of pain. When compared with rubber band ligation however, it is suggested that the procedure is associated with a higher level of pain.<sup>56</sup> There is also reference to prolonged pain lasting greater than 15 months. Although the etiology remains unclear, postulated causes included the incorporation of smooth muscle into the doughnut and the induction of a staple line inflammatory response in the rectal ampulla resulting in irritability and pain. Placement of the purse-string suture in relation to the dentate line, whether this be too far above or below the line, or with an inadequate depth has also been suggested.<sup>5</sup> These factors are thought to contribute to the development of prolonged pain and that ideal placement of the suture approximately 3 to 4 cm above the dentate line may result in less pain being experienced.<sup>5,23</sup> The presence of persistent hemorrhoidal disease, sphincter spasm, rectal spasm, high anal resting pressures, anal fissures, retained staples, and fibrosis around the staple line, wound dehiscence, and sepsis, were also identified as contributing factors to

excessive and/or prolonged pain.<sup>31,48</sup> It was also suggested to occur more frequently in males and people with grade 4 hemorrhoidal disease, or those with high anal sphincter pressures.<sup>31,48</sup> A low threshold for suspicion of complications should exist in patients suffering prolonged and severe pain following a stapled hemorrhoidopexy.

A definitive cure for prolonged pain following stapled hemorrhoidopexy was not identified. Proposed interventions included internal sphincterotomy, chemical and surgical manipulation of the pudendal nerve, staple extraction, and local application of analgesics. The use of agraffectomy involving staple line excision and manual refashioning of the anastomosis was also suggested.<sup>62</sup>

Review of the available literature has identified selection criteria to assess patients' suitability for stapled hemorrhoidopexy, including circumferential and multiple sites of stage III hemorrhoids and use in patients who have failed rubber band ligation. Patients who prefer a "painless" alternative for hemorrhoid removal and are willing to accept the higher recurrence rate are good candidates for staple hemorrhoidopexy.

It has been suggested that stapled hemorrhoidopexy is not recommended for patients with high grade, symptomatic external hemorrhoids; and those who have grade IV hemorrhoids should rather undergo a conventional hemorrhoidectomy. Articles also suggest that the procedure should only be performed in patients that have anodermal and hemorrhoidal prolapse, that can be manually reduced completely.<sup>25</sup> It is also suggested that it should not be performed in patients with other anal pathologies including fibrosclerosis and thrombosis, and those who engage in anoreceptive intercourse.<sup>54</sup> It is also suggested that to allow for the best patient outcomes, surgeons should be adequately and appropriately trained in this method of hemorrhoidectomy.

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