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Endorectal Advancement Flap Repair with the Use of Fluorescence Angiography: A Case Control Study

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Abstract

Background: Endorectal Advancement Flap (ERAF) is a technique that has been modified over the past century to treat anorectal fistulas. To further reduce complications with ERAF, Fluorescence Angiography (FA) has been utilized to assess flap perfusion. Here, we compare early outcomes of anal fistula repair utilizing ERAF with FA to traditional treatment modalities to assess safety and feasibility.

Methods: We retrospectively reviewed cases of complex fistula-in-ano repair by board certified colorectal surgeons from 2013 to 2017 at a single safety-net urban hospital. Patients who underwent fistulotomy, ERAF, and ERAF with FA were grouped by procedure type (Group A, B, and C, respectively).

Results: Sixty-four persons were identified that met inclusion criteria; 48 in Group A, 6 in Group B, and 10 in Group C. There was no difference in demographics between the three groups. Mean follow-up for all groups was 159.8 days (± 42 days). Group B and C had higher rate of prior surgeries (66.7% and 80%, respectively) when compared to group A (27.1%, p=0.001). Despite Group B and group C having a higher rate of complexity as suggested by a significantly higher re-operative surgery rate, there was no significant differences in postoperative complication rates among the three groups. There were no mortalities in either group.

Conclusion: ERAF with FA is safe and feasible and should be considered when managing complex fistula-in-ano.

Keywords: Anal fistula; Advancement flaps; Fluorescence angiography; Fistula-in-ano

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Introduction

Parks [1] originally describe four types of fistula-in-ano: Intersphincteric, transsphincteric, suprasphincteric, and extrasphincteric. High transsphincteric, extrasphincteric, and suprasphincteric fistulae are considered complex [2,3]. Furthermore, the presence of HIV, Crohn's disease, neoplasms, and tuberculosis add an additional level of complexity when considering treatment options [3-6]. Despite advances in the management of complex fistula-in-ano, there is a reported overall recurrence rate of 6% to 36% for all treatment modalities [7]. Specifically, for an Endorectal Advancement Flap (ERAF), failure to heal may be observed in up to 37% of patients despite the use of a broad-based flap to ensure adequate blood supply, as previously advocated [8-13]. This finding may be due to an inability to accurately assess tissue perfusion at time of flap creation. Fluorescence Angiography (FA) has emerged as a novel method for assessing mucosal perfusion and may shed light on whether ischemia contributes to flap failure. FA, specifically the use of Indocyanine Green (ICG), is a real-time imaging modality in which ICG is administered *via* the systemic circulation to assess perfusion. The dye adheres to plasma proteins, enabling improved assessment of blood flow and tissue perfusion [14]. Our group reported the first cases using FA to improve outcomes in patients with Complex Fistula-in-ano (CFA) [15]. Despite this advance, no report to our knowledge has compared outcomes of patients who underwent repair of CFA using rectal advancement flaps with FA to traditional approaches. Here, we compare early outcomes of anal fistula repair utilizing ERAF with FA to traditional treatment modalities to assess efficacy.

Table 1: Distribution of age, sex, height/weight, comorbidities, and ASA score.

	Fistulotomy (n=48)	ERAF (n=6)	ERAF + FA (n=10)	P value
Age, y, mean (SD)	40.9 (12.2)	41.2 (16)	41.6 (9.4)	P=0.421
Sex, n (%)				
Male	46 (95.8)	6 (100)	9 (90)	Pearson P=0.62
Female	2 (4.2)	0 (0)	1 (10)	
BMI, mean (SD)	25.3 (5.3)	26.5 (8.4)	26.7 (4.3)	P=0.178
Comorbidities, n (%)				
Diabetes	3 (6.25)	0	0	
HTN	13 (27.1)	0	1	
COPD	2 (4.2)	0	1	
Hepatitis	5 (10.4)	1 (16.7)	0	
HIV	29 (60.4)	2 (33.3)	1	
MI	1 (2.1)	0	0	
OSA	1 (2.1)	0	0	
ASA Score, n (%)				
1	0 (0)	0 (0)	0 (0)	
2	46 (95.8)	6 (100)	10 (100)	P=0.709
3	2 (4.2)	0 (0)	0 (0)	
4	0 (0)	0 (0)	0 (0)	
Prior Fistula Surgery, n (%)				
	11 (27.1)	4 (66.7)	8 (80)	P=0.001
Prior Surgery Type, n (%)				
Fistulotomy	9 (18.8)	1 (16.7)	1 (10)	
LIFT	0 (0)	0 (0)	0 (0)	
Seton	4 (8.3)	3 (50)	7 (70)	

Abbreviations: ERAF: Endorectal Advancement Flap; FA: Fluorescence Angiography; SD: Standard Deviation; BMI: Body Mass Index; HTN: Hypertension; COPD: Chronic Obstructive Pulmonary Disease; HIV: Human Immunodeficiency Virus; MI: Myocardial Infarction; OSA: Obstructive Sleep Apnea; ASA: America Society Of Anesthesiologist; LIFT: Ligation Of Intersphincteric Fistula Tract

Materials and Methods

Patient selection

We retrospectively reviewed prospectively collected data of patients undergoing both simple and complex fistula-in-ano repair at a single safety-net urban institution between 2013 and 2017. Institutional Review Board approval was obtained prior to the review. Board certified colorectal surgeons performed all procedures. Inclusion criteria consisted of patients with CFA. Patients who had a prior intervention for CFA were also included. Prior failed treatment modalities ranged from simple fistulotomy to ERAF. To assess the efficacy of FA used in conjunction with ERAF, we compared outcomes of patients who underwent ERAF with FA to those underwent ERAF alone and to the gold standard treatment, fistulotomy. Patients were then grouped by procedure type; fistulotomy, ERAF and ERAF with FA (group A, B, and C respectively). Cases that did not fit into these groups were excluded from further analysis. Pre-, intra-, and post-operative were recorded. Demographics, including co-morbid status, intraoperative data and 60-day outcomes were compared and analyzed using STATA 13 (College Station, TX).

Techniques for repair

Briefly, patients were brought to the operating room and placed in either the prone, jackknife or lithotomy position based on the location of the fistula. After placing a proctoscope, the internal and external opening was identified and confirmed with a probe and/or hydrogen peroxide injection through the tract. Draining Setons placed as the initial management where used to guided identification of the fistula tract. The procedure proceeded with either open fistulotomy or endorectal advancement flap with or without fluorescence angiography depending on the degree of involvement of the sphincter complex. The novel technique of endorectal advancement flap with intra-operative confirmation of viability with fluorescence angiography has been previously described [16].

Results

Sixty-four patients were identified. Forty-eight patients underwent fistulotomy, six patients underwent ERAF, and ten patients underwent ERAF with FA. There was no significant difference in age, sex, and ASA classification between the three surgical groups (Table1). The majority of the patients were male (95%) in all three surgical subgroups. The mean age for Group A, B, and C was 40.9, 41.2, and 41.6, respectively. Human Immunodeficiency Virus (HIV) positive patients made up 50% of the patients in this study. There was a significant difference in the rate of prior fistula surgery between the three groups (p=0.001); patients undergoing ERAF with or without FA had previously undergone surgery for their fistula at a rate of 67% and 80%, respectively. This finding is significantly higher than a rate of 27% for patients who underwent simple fistulotomy. Prior surgery was largely confined to fistulotomy or Seton placement: 50% of the ERAF group had a prior Seton placement and 70% of the ERAF with FA group had a prior Seton placement. Postoperatively,

Table 2: Early postoperative outcomes data.

	Comparison of Outcomes			
	Fistulotomy (n=48)	ERAF (n=6)	ERAF + FA (n=10)	P value
Complication Type, n, (%)				
Post-operative Urinary Retention	1 (2.1)	0 (0)	0 (0)	
Fecal Incontinence	0 (0)	0 (0)	1 (10)	
Abscess/Infection	4 (8.3)	0 (0)	0 (0)	
Flap Separation	0 (0)	1 (16.7)	1 (10)	
Complications Total, n, (%)	5 (10.4)	1 (16.7)	2 (20)	P=0.693
Mortality, n, %	0 (0)	0 (0)	0 (0)	

Abbreviations: ERAF: Endorectal Advancement Flap; FA: Fluorescence Angiography

the mean follow-up for all groups was 159.8 days (± 42 days). There were no recurrences of anal fistula during the follow up period for all patients in the study. The complication rate for Group A, B, and C was 10.4%, 16.7%, and 20% respectively with no significant difference seen. Complications included urinary retention, fecal retention, fecal incontinence, and abscess/infection and flap separation. There were no mortalities (Table 2).

Conclusion

Fistulotomy remains the standard of care for the management of fistula-in-ano. However, fistulotomy is generally reserved for simple fistula-in-ano; and has been showed to be an inferior technique in complex cases, including patients with high transsphincteric and suprasphincteric fistula-in-ano, as well as patients with recurrent fistulas or fistulas with secondary tracts [17-19]. These more complex cases remain a challenge to manage with no one technique showing clear superiority over others in terms of outcomes [20]. ERAF is one technique which has shown tremendous promise in the treatment of complicated fistula-in-ano [17-19]. ERAF was first described in the early 1900s and subsequently modified by using a partial thickness rectal wall flap to improve outcome [20,21]. The addition of FA for the determination of intra-operative viability to the modified ERAF technique has only recently been described [15]. This follow-up study's primary aim is to further establish feasibility and safety of this technique. After review of the data, we found the complication rate to be highest among patients undergoing ERAF with FA compared to ERAF and fistulotomy (20% *vs.* 10.4% and 16.7% respectively) although this finding was not significant. The rate of complication and total number of complications are not congruent due to differences in cohort size. Two out of ten patients undergoing ERAF with FA had a complication. The complications included fecal incontinence and flap separation. In the one case of flap separation, the flap had a decreased signal with FA after fixation but was not subsequently revised because of surgeon judgment and early learning curve of this technique. Although flap separation was identified at two-week follow-up, the flap and fistula tract were well healed at six-month follow-up. This distinction is clinically important as the technique of ERAF with FA advocates for the revision of the flap if intra-operative FA reveals decreased signal. It can be postulated that this early post-operative complication may have been avoided with revision of the flap based on FA findings. The rate of complication may be expected to be higher in patients undergoing ERAF with or without FA, as these patients tend to have more complex disease [8,22-24]. The complexity of their disease is partially evident by their selection for ERAF. In addition, a larger majority of patients undergoing ERAF with or without FA had previously undergone fistula surgery (67% and 80%, respectively). This was a significant finding. The history of prior fistula surgery has been previously identified as a poor prognostic factor for patients undergoing ERAF [8]. With the understanding that patients with complex disease and a history of prior fistula surgery are at a higher risk for complications, we propose the use of ERAF with FA may further improve outcomes in this clearly defined patient population. Our study is not without limitations. The findings would be better supported with a larger sample size, in which groups A, B and C were more adequately similar in quantity of patients. However, the ability to attain a large cohort of patients undergoing ERAF with FA is partially limited by the novelty of this technique and the selection of a patient with complex disease. Furthermore, the results are compromised by patient selection, as these patients were not randomized to treatment. This shortcoming is inhibited by the inability to randomize patients with simple fistula-in-ano to a more complex procedure. Lastly, this study does not provide any information regarding long-term follow-up. Despite these shortcomings, the findings of this study further confirm the practical safety and feasibility of this novel technique.

Conclusion

ERAF with FA facilitates real-time assessment of flap perfusion prior to final fixation in fistula repair. This technique, although novel, may be of particular use in patients with complex fistula-in-ano in which no standard of treatment has yet to be elucidated. Furthermore, the adjunct of FA with ERAF may help to improve outcomes in those patients with complex disease, in whom we expect challenges to cure. Thus, we conclude that ERAF with FA is both a feasible and safe procedure for fistula-in-ano.

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