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ORIGINAL ARTICLE

Anterior Cervical Surgery: Drain Needed or Not?

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ABSTRACT

Study design: Retrospective cohort study.

Objective: To recognize the factors that influence drain output and based on the results to formulate certain guidelines which help in deciding drain placement in patients who have undergone anterior cervical discectomy (ACD) surgeries.

Summary of background data: The common worry of operating surgeon after anterior cervical discectomy and fusion (ACDF) surgery is postoperative neck hematoma. To avoid this, there has been a traditional practice to keep the drain postoperatively. Drain placement has got inherent complications, like infection risk, postoperative pain, increased analgesic use and increased length of hospital stay.

Materials and methods: All patients who underwent elective ACD surgeries with surgical drain placement in our institution between from Jan 2011 and July 2014 were identified using operation theater (OT) records. Patient information was abstracted from the medical records section. Patients were categorized on the basis of normal or increased total drain output, with increased drain output defined as total drain output 50th percentile (20 ml) or more. A multivariate logistic regression was used to determine which factors were independently associated with increased drain output.

Results: A total of 161 patients with ACDF met inclusion criteria. Total drain output was in the range from 0 to 300 ml. Among all patients in the study, 67 patients had increased drain output (drain output ≥50th percentile or 20 ml). Multivariate analysis identified three independent predictors of increased drain output: BMI, number of levels (≥2 levels) and implants.

Conclusion: Patients with the factors, like increased BMI, two or more level surgery and implants placed may benefit from surgical drain placement after ACD surgeries.

Keywords: Anterior cervical discectomy, Drain output, Postoperative drain.

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INTRODUCTION

Cervical spondylosis and cervical disk prolapse are common diseases encountered in neurosurgery. Cervical spondylosis is more common after the 4th decade.[1] The most common presentation of these entities is neck pain varying from occasional discomfort to severe debilitating pain often associated with radicular symptoms. In a significant number of patients, myelopathy features are also seen.[2] Anterior cervical discectomy with or without fusion is the most common surgical treatment in these patients.[3] Fusion can be achieved by iliac autograft, artificial bone graft or prosthesis with very good results.[4]

The common anxiety of operating surgeon is postoperative neck hematoma[5] and, therefore, it has been a traditional practice to keep the drain postoperatively. Drain placement is an additional procedure with possibilities of complications, like infection risk, postoperative pain,[6] increased analgesic use and increased length of hospital stay. Similar practice was followed by general surgeons and oncosurgeons for cases, like thyroidectomy, parathyroidectomy and neck dissections. However, in recent past many studies were done and it was found that in some of surgeries drain was not necessary.[7,8] At the same time, certain guidelines were formulated based on which the decision of drain placement is done.

The use of prosthesis has become common in cervical spine surgeries. It is thought that these procedures have more chances of collection in postoperative period. Orthopedicians were using drains frequently based on same assumptions in all prosthetic surgeries. However, many studies in their group also did not favor drain placement.[9,10] In neurosurgical practice, it was shown that drain placement for single level lumbar surgery was not necessary and instead it was associated with increased wound infection.[11] However, multilevel surgeries in lumbar surgeries will need drain.[12]

Considering all these facts, we evaluated our patient data retrospectively to see the factors that influence drain output and based on these to formulate certain guidelines which help us in deciding drain placement. To our knowledge, only one similar study is done which evaluated fewer risk factors affecting drain output than our study.

MATERIALS AND METHODS

Data Source

All the patients operated who underwent ACD surgeries for subaxial cervical spine with drain placement in our institution from Jan 2011 to July 2014 were recruited

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in the study. Records of these patients were taken from medical records section and analyzed. These surgeries were performed by five neurosurgeons. All the operating surgeons were keeping drains regularly.

All the cases where records could not be traced, incomplete records, patients younger than 18 years, surgeries involving C1, C2 and simultaneous use of posterior approach or 360° fusions were excluded from the study. Those surgeries where anterior approach was used for indications, like trauma, excision of malignancy, tubercular or other infectious diseases were also excluded from the study. Approval for the study was taken from our institutional review board.

Data Collection

Once inpatient number and records were available various data were collected. Age, sex of the patient and BMI were noted. History of smoking was taken from resident notes. Occasional smokers and use of nicotine in other forms were excluded. History of comorbidities, like hypertension, diabetes, pulmonary, cardiac, renal and bleeding disorders were taken from resident notes. Patients on aspirin were included in bleeding disorder group. Pulmonary diseases included asthma and COPD, whereas cardiac included valvular, arrhythmic, ischemic and congestive cardiac failure.

American Society of Anaesthesiology (ASA) score was obtained from preoperative anesthetic evaluation chart. Preoperative laboratory parameters like hematocrit and INR were taken from records and cross confirmed with laboratory data registry. Other details, like operative time, use of iliac or artificial bone graft and prosthesis type, levels of surgery and whether corpectomy was done were taken from resident operation theater (OT) notes.

Drain output

Details of drain output were noted from resident postoperative daily notes and cross confirmed with nurses notes. Drain output was taken as the total output from time of placement till its removal irrespective of number of days it was kept. Measurement of drain output had been recorded in milliliters in all cases. Drains were removed based on the operating surgeon's decision. The primary outcome measure taken was increased drain output which was considered positive when drain output was more or equal to median drain output for this group of patients (≥20 ml).

STATISTICAL ANALYSIS

Statistical analyses were conducted using STATA version 11.2. All tests were two-tailed and the statistical difference was established at a two-sided α level of 0.05 ($p < 0.05$). Demographic, comorbidity and procedural variables were tested for association with increased drain output using bivariate and multivariate logistic regression. Final multivariate model was constructed that initially included all potential variables and sequentially excluded variables with the high p-value.

RESULTS

A total of 161 patients with ACD surgeries met inclusion criteria out of 198 patients who underwent anterior cervical surgeries. Patients excluded were mainly because of non-availability of complete data from records. Demographic data are shown in Table 1. Mean age was 44.7 ± 11.170 years [mean ± standard deviation (SD)]. The

Table 1: Demographic profile of the recruited cases

Characteristics		*Number*	*Percentage*
Overall		161	100.0
Age	<45 years	86	53.4
	≥45 years	75	46.6
Gender	Male	131	81.4
	Female	30	18.6
BMI	<18	4	2.5
	18–25	128	79.5
	26–30	29	18.0
ASA class	1–2	149	92.5
	2–3	12	7.5
Preoperative hematocrit	≥36	145	90.1
	<36	16	9.9
History of smoking	No	134	83.2
	Yes	27	16.8
History of hypertension	No	143	88.8
	Yes	18	11.2
History of diabetes	No	136	84.5
	Yes	25	15.5
History of heart disease	No	146	90.7
	Yes	15	9.3
History of pulmonary disease	No	151	93.8
	Yes	10	6.2
History of renal failure	No	156	96.9
	Yes	5	3.1
History of bleeding disorder or on aspirin	No	153	95.0
	Yes	8	5.0
Number of levels	1	124	77.0
	2	33	20.5
	3	4	2.5
Use of iliac crest bone graft	No	99	61.5
	Yes	62	38.5
ARTI BG	No	103	64.0
	Yes	58	36.0
Implants	No	80	49.7
	Yes	81	50.3
Corpectomy	No	150	93.2
	Yes	11	6.8
Operative time	<120	39	24.2
	≥120	122	75.8
Drain output	≥20	90	55.9
	<20	71	44.1

average drain output for this cohort was 33.26 ± 43.197 ml and median was 20.00 (0–350) ml.

Overall, 90 (55.9%) patients had increased drain output (drain output ≥ 50th percentile or 20 ml). The percentage of patients with increased drain output is stratified by demographic, comorbidity, and surgical characteristics in Table 2. Bivariate analysis examining the effects of each variable on odds of increased drain output is shown in the middle columns of Table 2. This analysis showed significant association between increased drain output and body mass index (BMI), number of levels, implants use, corpectomy and use of iliac bone graft. Further multivariate analysis was then used to measure the effects simultaneously of each variable on drain output while controlling for confounding variables (right columns of Table 2). This analysis showed that significant predictors of increased drain output were BMI [18–25 odds ratio (OR) = 2.499, 95% confidence interval (CI) = 0.414–0.910; 26–30 OR = 14.802, CI = 1.957–111.968, p = 0.002], number of levels (2 levels OR = 21.062, 95% CI = 3.537–71.609; 3 levels

Table 2: Bivariate and multivariate analysis

Characteristics		*Percentage of cases with increased drain output**	*Bivariate†*		*Multivariate analysis†‡*	
			Odds ratio	*p-value*	*Odds ratio*	*p-value*
Overall		55.9				
Age	<45 years	50.0	Ref.	0.106		
	≥45 years	62.7	1.679			
Gender	Male	57.3	Ref.	0.747		
	Female	50.0	0.471			
BMI	<18	25.0	Ref.		Ref.	0.033
	18–25	47.7	2.73	<0.001	2.499	
	26–30	96.6	84.0		36.842	
ASA class	1–2	54.4	Ref.	0.166		
	2–3	75.0	2.519			
Preoperative hematocrit	≥36	53.8	Ref.	0.105		
	<36	75.0	2.577			
History of smoking	No	56.7	Ref.	0.642		
	Yes	51.9	0.822			
History of hypertension	No	53.8	Ref.	0.139		
	Yes	72.2	2.229			
History of diabetes	No	55.9	Ref.	0.991		
	Yes	56.0	1.005			
History of heart disease	No	55.5	Ref.	0.737		
	Yes	60.0	1.204			
History of pulmonary disease	No	55.0	Ref.	0.354		
	Yes	70.0	1.912			
History of renal failure	No	55.8	Ref.	0.851		
	Yes	60.0	1.190			
History of bleeding disorder or on aspirin	No	55.6	Ref.	0.700		
	Yes	62.5	1.333			
Number of levels	1	44.4	Ref.		Ref.	
	2	93.9	19.44	<0.001	21.062	0.001
	3	100.0	0.00		0.00001	
Use of iliac crest bone graft	No	46.5	Ref.	0.002		
	Yes	71.0	2.816			
Corpectomy	No	53.3	Ref.	0.015		
	Yes	90.9	8.750			
Operative time	<120	46.2	Ref.	0.159		
	≥120	59.0	1.680			
ARTI BG	No	51.5	Ref.	0.130		
	Yes	63.8	1.662			
Implants	No	33.8	Ref.	<0.001	Ref.	<0.001
	Yes	77.8	6.870		7.158	

*Increased drain output was defined as drain output 50th percentile (20 ml) or more, †Bolding indicates statistical significance (p < 0.05), ‡The final multivariate model was constructed using a backward stepwise process that initially included all potential predictor variables and sequentially excluded variables with the highest p-value until only those with p < 0.20 remained. Variables with 0.05 < p < 0.20 are left in the model to control for potential confounding, but are not considered to be statistically significant

OR = 0.00001, 95% CI = 0.00-; p = 0.002) and implants use (odds ratio = 7.1578, CI = 3.106–16.498).

Corpectomy and use of iliac bone graft were associated with increased drain output on bivariate analysis but this association dropped out of significance on multivariate analysis. Rest of the factors analyzed were not significantly associated with increased drain output. Review of postoperative data revealed that one patient had a significant drain output (350 ml) but was not associated with symptoms. It was high on first three postoperative days and then subsided. It was further noted that same patient had undergone long duration three level surgery with corpectomy.

DISCUSSION

Anterior cervical discectomy surgery is a common surgical procedure for which many surgeons routinely place a surgical drain with the goal of reducing postoperative hematoma.[13,14] The efficacy of drains has been challenged for many surgical procedures; however, very few studies have assessed the necessity of drain use after ACD surgeries. This study was designed to identify factors that affect drain output after ACD surgeries to help surgeons to decide about drain requirement. We found that BMI, number of levels and use of implants were independently associated with increased drain output. Rest of the factors were not significantly associated with increased drain output after ACD surgeries (Table 3).

We found only one study for direct comparison that used multivariate analysis to identify factors associated with increased drain output in ACD surgeries. Basques et al[15] in their study found that age, number of levels and history of smoking were independently associated with increased drain output. However, the above study did not take into consideration of factors, like implant and artificial bone placement for evaluation and showed no correlation between BMI and drain output.

In our study, patients with increasing BMI were more likely to have increased drain output after ACD surgeries. This effect may be due to delayed wound healing associated with increased BMI. As the number of levels involved in the procedure increased, there was a corresponding rise in drain output. Basques et al study also found an association between multilevel procedures and increased drain output. Few studies have found drain output increases in multilevel lumbar surgery.[16,17] Multilevel procedures are associated with increased dissection and exposed bony surfaces, which could account for increased postoperative drainage. Increased age and smoking history which were significant risk factors in their study were not found to be significant by us.

Corpectomy and use of iliac bone graft were significantly associated with increased drain output on bivariate analysis (may likely be due to covariance with other predictor variables) but both variables failed to show statistical association with increased drain output in the multivariate model ($p > 0.05$).

Limitations of this study include its retrospective nature and differences in practice of surgeons. Surgical technique and criteria for drain removal were not standardized. This study evaluates factors predicting increased drain output but not amount of drain output that can be directly linked to increased risk of clinical complications. By performing this study at a single institution, hospital-related confounding variables were reasonably controlled.

Table 3: Final conclusion

Significant in multivariate analysis	*Odds ratio*	*95% confidence interval*		*p-value*
BMI				
< 18	*Ref.*	—	—	0.002
18–25	0.614	0.414	0.910	
26–30	14.802	1.957	111.968	
Number of levels				
1	Ref.	—	—	0.002
2	15.914	3.537	71.609	
3	0.00001	0.000	—	
Implants				
No	Ref.	—	—	< 0.001
Yes	7.1578	3.106	16.498	
Not significant in multivariate analysis, but significant in bivariate analysis				
Use of iliac crest bone graft				
Corpectomy				
Not significant in multivariate analysis or bivariate analysis				
Age/gender/ASA class/preoperative hematocrit/history of smoking				
History of hypertension/diabetes/heart/pulmonary/renal disease				
History of bleeding disorder or on aspirin/operative time/artificial bone graft				

CONCLUSION

This study is the first of its kind in Indian population to identify factors associated with increased drain output after ACD surgeries by verifying many of the variables. Though the decision to use a drain after ACD surgeries is at the surgeon's discretion, the results of this study suggest that patients undergoing a single-level ACD with or without bone graft are less likely to have increased drain output. Drains may not be necessary in this group. Conversely, patients with high BMI, patients undergoing multilevel ACD surgeries and use of implants are more likely to have an increased amount of drainage and may need drain placement. Bone graft per se whether artificial or iliac were not found to increase drain output.

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