PREOPERATIVE FACTORS AFFECTING THE LENGTH OF STAY AFTER ELECTIVE ANTERIOR CERVICAL DISCECTOMY

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ABSTRACT

Objective: To determine Preoperative factors affecting the length of stay after elective anterior cervical discectomy. **Design:** A retrospective study. **Place and Duration of Study:** This study was conducted in the Department of Neurosurgery, BMC/SPH Quetta from February, 2015 to March 2016. **Patients and Methods:** This study was conducted in a BMC/SPH, Quetta. The medical records of the patient who had to undergo anterior cervical surgery in the past 5 years were filtered out and traced back for an interview. Medical records, reports and follow up notes were analysed for determining the outcome for this procedure. Inclusion criteria included those patients whose characteristics followed the criteria set for the selection of the patient such as demographics, comorbidities, age, and past medical history. The exclusion set for patient selection includes traumatic incident, malignancy excision, previous infection, under 18 years old person, total disc replacement, concomitant posterior cervical arthrodesis, thoracic or lumbar spine surgery, or other unrelated procedures. The patient was tracked down from the billing information and the medical records from the database of the hospital. **Results:** The range for the length of the stay was from 1 to 21 days. The average length of the stay observed was 2 days +/- 2.5 days. Therefore, the stay longer than 3 days was considered an extended period of stay. It was observed that 19 % of patients were on the extended stay. These percentages were calculated based on two categories; demographics and comorbidities. The covariance was calculated and analysed for each independent variable. Total variables, which were calculated, are 15 and we made 105 combinations. Out of this 77 did not show significant p-value. 10 combinations indicated a significant result $p < 0.001$. **Conclusion:** After over

viewing the medical records, lab findings and follow up reports the study pointed out that the association of comorbidities such pulmonary disease and surgical procedure like corpectomy to the extension of the length of the stay at the hospital, However, while determining the causality a careful watch is required, retrospective study do not provide good and valid evidence at times.

KEYWORDS: Preoperative factors, anterior, cervical discectomy.

INTRODUCTION

Anterior cervical discectomy and fusion is a form of neck surgery, aims to remove the damaged disc that relieves the nerve root compression; hence, relieves the pain, numbness, weakness and tingling sensation. This surgery consists of two parts discectomy and fusion surgery. The surgical procedure begins with a discectomy in which the patient is approached from the anterior side (front position) and the disc between the two vertebra is removed.[1] After the removal of the disc, the vertebra becomes unstable; hence, the second procedure is performed immediately, that is fusion.[1] The vertebra is stabilised and strengthened with the help of the bone graft or the implants in the people who display a symptomatic herniation of the cervical disc.[2] This procedure is often performed for removing the bone spur that compresses the nerve and alleviates the symptoms caused by the arthritis in association with cervical spine stenosis.

This anterior approach exclaims several advantages associated with it such as firstly, it allows the direct visual access to the assess the disc that is subject to herniation, stenosis and slip disc. This anterior approach allows visualising the disc from level C2 to C7 and T1.[3] Secondly, it causes less operative pain. As the approach is direct; hence, less incisional cuts and less pain.

Another causative factor for using this procedure is degenerative disc disease that is spondylosis. As the disc comprises of 80% water; hence, dehydration of the disc results in the shrinkage of the disc which causes instability of the disc, tears the annulus and cause inflammation of the nerve root.[4] A contraindication of the procedure at some places is pointed out by some authors such as bone morphogenetic protein, which is not allowed to be checked in such procedures because it causes the swelling of the soft tissue which might be a life-threatening condition.[5]

Postoperative management requires 1 to 3 day stay in the hospital; however, recovery takes 1 to 6 weeks.[3] With the advancement in the technology, the use of endoscopic microdiscectomy has eased out the procedure and reduced the post-operative recovery time up to 2 days. During the recovery period, the physician advised the patient to wear a neck collar or a brace for a period of 8 weeks that assures proper spinal alignment; however, a disadvantage associated with a brace is that it keeps the posture of the neck straight and restricts the movement of the neck. This causes slow recovery and healing of the neck due to the stiffening of the neck.

With time this procedure has become a very common technique for treating any cervical spine pathology as it is an efficient and safe procedure. According to the surgeon, stay length at the hospital after the procedure proves beneficial for the patient and the providers.[1] As per the literature, the longer the duration of the stay is proportional to the increased risk of complications such as postoperative infection, venous thromboembolism, and delirium.[3,4] As per the authors, the identification of the factors affecting the length of the stay in hospital is very critical in order for better understanding of the better outcome.[5]

As per a previous clinical trials have pointed out several factor that affect the length of stay in hospital that includes age, gender, ethnicity, insurance status, geographic location, comorbidity index, heart disease, renal disease, pulmonary disease, hypertension, diabetes, functional status, preoperative anemia, preoperative opioid use, presence of traumatic cervical spine injury, myelopathy, multilevel decompression, extended operating time, and postoperative complications.[4,6,7]

The results and study method of the previous studies displayed variation, this caused doubt in the validity of the research. This might be due to the skewness of the outcome because of the inclusion of the traumatic patient and postoperative events. Therefore, this research was conducted to validate the results and reduce any variation, which was detected in previous studies.

Post operative complications

After each surgical procedure, there is always a chance of the occurrence of the post operative complications. These complications are most likely to occur when the patient is suffering from any previous comorbidity or have undergone a surgical procedure such as corpectomy. Common complications that are observed include open wound infection,

surgical site infection, wound dehiscences, pulmonary infections, renal infections, nerve injury, most commonly deep venous thrombosis, sepsis or revised surgical necessity.

METHOD

This is a retrospective study, which was conducted in a Bolan Medical College /SPH, Hospital Quetta. The medical records of the patient who had to undergo anterior cervical surgery in the past 5 years were filtered out and traced back for an interview. Apart from this, associated medical records, reports and follow up notes were analysed for determining the outcome for this procedure.

Inclusion criteria included those patients whose characteristics followed the criteria set for the selection of the patient such as demographics, comorbidities, age, and past medical history.

The exclusion set for patient selection includes traumatic incident, malignancy excision, previous infection, under 18 years old person, total disc replacement, concomitant posterior cervical arthrodesis, thoracic or lumbar spine surgery, or other unrelated procedures.

The patient was tracked down from the billing information and the medical records from the database of the hospital.

Data collected included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, preoperative hematocrit, history of smoking, and history of major medical comorbidities (non-spinal malignancy, diabetes mellitus, pulmonary disease, hypertension, heart disease, or bleeding disorder/currently taking aspirin).

To assess the patient for the factor of preoperative risk undergoing surgery; evaluation is conducted according to the ASA classification by the anaesthesiologist. ASA 1 indicates normal patient, ASA 2 indicates a mild systemic disease, ASA 3 indicates a severe systemic disease, ASA 4 severe systemic disease, and a threat to life, ASA 5 indicates a moribund patient who is unable to survive without the surgery and ASA 6 indicates a dead person. Our study includes only above 4 categories in the study. First two category is dealt as one category and third and, fourth is taken as one category.

From the medical records .the preoperative reports of the hematocrit of the patient were retrieved, evaluated and sorted into categories. Each patient included in our study did not have a test taken because it was expected that the majority would have normal hematocrit.

The hematocrit level below 36.0 is considered as low. As per the result analyses, 22% of patient enrolled did not have the results of the preoperative hematocrit test. Either the results got misplaced or the doctor felt that there was no need for the test. However, all these patients were included whether the test result was there or not.

Next, the patient was individually analysed for any systemic disease. Any condition involving the non spinal malignancy in which the patient was previously exposed to radiation, chemotherapy or surgery that did not involve the spine. Preoperatively the patient was assessed and evaluated for diabetes, hypertension., heart disease, pulmonary disease, and bleeding disorder.

Further variables evaluated preoperatively the number of the levels to be fused, use of corpectomy and bone graft application. The length of the stay was used as a primary variable for measurement of specific point that was selected to avoid any inclusion of the outliers in the analysis.

Statistical analysis
Statistical analysis was conducted on SPSS 21 using the multivariate regression. The p-value set was < 0.05. Any variable, which showed the result $0.05 < p$-value was left for the adjustment of the confounding variable. Therefore, meanwhile, they were not considered significant for the study.

Patient selection
This research was conducted in 100 patient recruited from the medical records of the Quetta hospital. 130 patients were filtered out from which 30 patients were excluded as they did not fit the inclusion criteria. The average age of the patient assessed was 49 years +/- 10 years (mean +/- standard deviation), the BMI calculated was 28 kg/m2 +/- 6 and more than 50 % were the females included in the study. Each of the patient included in the study had one systemic disease associated with this problem such as prostate cancer, lung cancer, hepatic cancer, Hodgkin, breast cancer, thyroid cancer, tonsil cancer, lymphoma, and melanoma.

RESULTS
The range for the length of the stay was from 1 to 21 days. The average length of the stay observed was 2 days +/- 2.5 days. Therefore, the stay longer than 3 days was considered an extended period of stay.

It was observed that 19 % of patients were on the extended stay. These percentages were calculated based on two categories; demographics and comorbidities. The covariance was calculated and analysed for each independent variable. Total variables, which were calculated are 15 and we made 105 combinations. Out of this 77 did not show significant p-value. 10 combination indicated a significant result $p < 0.001$, this included age with sex, ASA classification, hypertension, history of a bleeding disorder, BMI, history of malignancy while other combination of hypertension and diabetes with BMI, ASA classification, graft and smoking.

According to the univariate analysis the variables which influenced the stay at the hospital were identified as gender mostly women, age, BMI (low), diabetic, dyspnoea, dysphagia, COPD, heart disease, hypertension, ASA classification and longer operative time. As per literature, it was seen that the longer the patient stays in the hospital the more complication can occur; hence, it was noticed many patient who had normal stay in the hospital did not reported any complications; 95% were normal, 3% reported one complication and 2% showed more than one complications.[3,4,7]

While in our study it was observed that in an extended stay in the hospital the percentage dropped for no complication to 78%, 15% for one complication and 7% for more than one complications.

However, the rate of complication occurrence is low; this was divided into three categories 1,0 and >1 in the multivariate regression. The risk by the surgeon was considered low but still there was always a chance of its occurrence.

The bivariate analysis showed a significant relationship between prolonged stay and ASA class, preoperative, hematocrit less 36.0, history of non spinal malignancy, pulmonary disease, hypertension, heart disease, number of levels fused and corpectomy. With regression the confounding variables were adjusted; thus, validating the result.

Table 1: Demographics and Comorbidity.

	Number	Percent
Overall	183	100%
Age		
18–39	24	13.1%
40–49	57	31.2%
50–59	57	31.2%
≥60	45	24.6%
Sex		
Female	97	53.0%
Male	86	47.0%
Body mass index[*]		
18–25	41	22.7%
25–30	66	36.5%
30–35	43	23.8%
≥35	31	17.1%

	Number	Percent
ASA class		
1–2	116	63.4%
3–4	67	36.6%
Preoperative hematocrit		
≥36.0 or not drawn	167	91.3%
<36.0	16	8.7%
History of smoking		
No	98	53.6%
Yes	58	46.5%
History of non-spinal malignancy		
No	171	93.4%
Yes	12	6.6%
History of diabetes		
No	157	85.8%
Yes	26	14.2%

	Number	Percent
History of pulmonary disease		
No	136	74.3%
Yes	47	25.7%
History of hypertension		
No	110	60.1%
Yes	73	39.9%
History of heart disease		
No	156	85.3%
Yes	27	14.8%
History of bleeding disorder or on aspirin		
No	167	91.3%
Yes	16	8.7%

	Number	Percent
Number of levels		
1	91	49.7%
2	76	41.5%
3	15	8.2%
4	1	0.6%
Corpectomy		
No	166	90.7%
Yes	17	9.3%
Use of iliac crest bone graft		
No	120	82.0 %
Yes	32	18.0%

ASA = American Society of Anesthesiologist

Furthermore, the multivariate analysis indicated a significant association between prolonged length of stay and non spinal malignancy history (p = 0.03), pulmonary disease (p = 0.002) and corpectomy (p = 0.022). While the rest combination was seen as insignificant, as the p value was > 0.05.
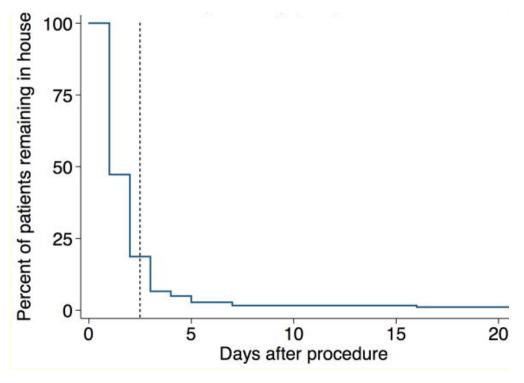

Figure 1: Length of the stay after ACDF.

The outcome was set to a 95% confidence interval with an odd ratio for each variable in the multivariate. Observing the variables in the bivariate analysis it was seen that there were some other factors that only indicated significance in bivariate analysis such as ASA class, preoperative hematocrit < 36.0, history of hypertension, history of heart disease, and a number of levels fused. Hence, this pointed out the covariance between these variables and the one significant on the multivariate analysis. Nevertheless, age, gender, BMI, hypertension, diabetes, graft and bleeding disorder did not show ant relation in both analyses.

DISCUSSION

According to the authors, the hospital stay after the surgery is considered as an important factor in the recovery of the patient.[6,8] However, there are some variables who's information was inconsistent and were left behind for adjustment for the confounding variables. Following the other studies, multivariate was used in the research for describing the factors that influence the extend of the length of stay in the hospital. The patient was closely

evaluated for preoperative comorbidities associated and previously undergone a surgical procedure. Hence, there was a clear relation and explanation for the extension of the stay. The aim of this evaluation was to classify the factors that could influence surgical expectations preoperatively.

Each patient was assessed based on the past medical history of non spinal malignancy, history of pulmonary disease and corpectomy. Our authors observed that these variables were independent of the risk factor for an increase in the length of stay with odds ration around 4.5. However, age, gender, BMI, any comorbidities, preoperative hematocrit level less than 36.0, number of levels fused and bone graft did not show a particular association.

To our knowledge, we weren't able to gather any such research related to the non spinal malignancy association to the extension of the length of stay after the anterior discectomy surgery. Nevertheless, it was observed from the record that the presence of any comorbidity or underlying illness leads to an extension of the hospital stay. Specifically, the postoperative complication such as thromboembolism was considered one of the main reasons for long-stay back.

One of the complications highlighted by the surgeons, which was associated with another independent variable was the age with venous thromboembolism.[3] It was observed that the patient who had increased age, displayed deterioration in their health when they were kept for prolonged period in the hospital. Prolonged bed rest for such patient leads to impediment in the blood flow leading to venous thromboembolism. Therefore extended stay at the hospital leads to not only post operative complication but also increase in the cost for the patient.[9] The history of the pulmonary disease was also one of the causative factors, which we observed in the medical record that leads to increase stay in the hospital. Other authors research paper also supported the fact that the pulmonary disease presence leads to the extension in the stay of the patient after the surgery.[1,4] These COPD and asthma patients are at higher risk for complication; hence, their stay is prolonged in order to provide them with extra care.[10]

Analysing the past medical history of the patient it was observed that those patient who had previously undergone any surgical procedure such as corpectomy are at higher risk than who just underwent the only discectomy. However, no relation was found between intraoperative or postoperative complication and anterior discectomy with or without corpectomy.

However, a particular variable is in a controversial position. As per a study in a bivariate model the number of levels to be fused showed a significant relation. However, in our multivariate study, this variable did not show any significance. One reason suggested was that in our study we considered corpectomy as an individual variable in the multi level procedure, which was not given importance in the bivariate analysis; hence, the inclusion of this variable changed the position of the number of levels in the study.

Our study presented different results in comparison to previous studies. The previous research pointed out a significant connection of the prolonged stay with age, BMI, hypertension, diabetes, and a number of levels fused. The suggestive reason for the difference is that our study included different predictors in a multivariate model, difference in inclusion criteria, the difference in surgical procedure and discharge criteria. This difference in the result showed a positive aspect of conducting the study on different population; hence, provided a statistical analysis of the different places based on similar variables. Thus, it provides a different outlook for each location and validates the experiments. This best characterises the factors according to the different locations.[4]

Limitation of the study relies on two important factors; firstly, it is a retrospective study and secondly, the difference in the practices of the surgeon.[1,4] The retrospective study always depends upon previous history and records. Any missing or forged filled notes can leave a gap in the study. However, this retrospective nature provided a positive point, as the observer effect was avoided such as the surgeons did not play any role of pushing for earlier discharge due to the study, which could be a source of biasness. Despite limitation of the study as per the study although some medical illness is associated with the extension simultaneously it can be observed that surgeons preference plays an equal role in the stay period of the hospital as well.More over, involving multiple surgeons in the study created difficulty in coordinating with them as they each had different discharge criteria set and each have a unique technique to perform the procedure.

Recently, the out patient treatment have been very common in which the discharge was on the same day. However, there was no such inclusion in our study; hence, our study was more inclined towards an institutional firm, which governs on some basic principles and proper treatment planning set by the surgeons. As per the literature, the hospital staff does not easily allow the discharge of the patient without checking all the following metrics.[5,11] The metrics

include your ability to walk and eat, the level of pain, the health condition and the preexisting spine condition most importantly.[12]

Once the patient leaves the hospital, 3 – 6 months is the minimum time period for a patient to follow up as this is the healing time period for the patient. Some patient shows quick recovery within less than 3 months and they return back to their normal routine. However, it was observed that the quick repair in the patient all depended upon the speed of the spine fusion.

However, this treatment modality remains main stay for both neurosurgeons as well as an orthopaedic surgeon. As this treatment does not requires extended stay period, it is advised that this procedure can be performed in an outpatient department as well; thereby, decreasing the stress for long stay and decrease the burden of the cost.

One of the post operative complication that prolongs the time extension is dysphagia. The care department awaits until patient is tolerant for oral intake. Revised surgery can increase the pain tendency and further prolongs the time and complications.

Although we successfully identify the variables but we still underestimate them at some point due to the nature of study. It can be considered as another limitation of the study is that despite the effort to incorporate each of the comorbidity but still some of the comorbidities and complication were not included in the study.

Another particular variables that did not show significance was commented upon based on the literature was age. The patients who came for follow up were thoroughly evaluated for the progress of the spine fusion. It was observed that patient who were older and had preoperative systemic diseases were most likely to stay more than 2 days at the hospital. However, no particular comorbidity can be directly associated with the extension of the stay. After Anterior cervical discectomy and fusion it was noted that 1 in every 30 patients reported complication with extended stay above 3 to 4 days. Few authors reported that the use of iliac crest graft was associated with extend operation time, extended stay and post operative blood transfusion. However, our study was not able to find any significance.

This study was able to successfully determine the factors, which are responsible for provoking extension of the hospital stay. Three important variables were determined through this study to be responsible for extension of the stay. Two of the factors were similar as per

the previous studies that are corpectomy and past history of the pulmonary disease. However, age, gender, different comorbidities, BMI, smoking, level to be fused and bone graft did not show any association with the extension of the time period of stay at hospital. We are hoping that this information will be beneficial to the patients and providers to facilitate discussion and work for appropriate expectations about hospital LOS following elective ACDF procedures.

CONCLUSION

After overviewing the medical records, lab findings and follow up reports the study pointed out that the association of comorbidities such pulmonary disease and surgical procedure like corpectomy to the extension of the length of the stay at the hospital, However, while determining the causality a careful watch is required, retrospective study do not provide good and valid evidence at times.

It was appreciated that with increasing age the risk for acquiring the post operative complication increases. Hence, older people with any comorbidites were given extra care with an extension of the stay at hospital if required. However, the authors suggested that the complications and comorbidity though influenced the length of the stay at the hospital, still major influence was seen through the surgeons preference and advise. This suggestion of the other authours complied with our study's outcome.

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