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ORIGINAL ARTICLE

Frequency of Surgical Site Infection in Response to Single Dose Antibiotic Prophylaxis in Lumbar Intervertebral Disc Excision

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ABSTRACT

Objective: To measure the frequency of infection with single dose antibiotic prophylaxis in surgery for intervertebral disc prolapse.

Patients and Methods: This cross-sectional study was conducted at the Department of Neurosurgery, Pakistan Institute of Medical Sciences, Islamabad for ten months. In total 400 patients both male and female, undergoing surgery for lumbar disc herniation (single level lumbar intervertebral disc), meeting inclusion criteria, were selected for the study. Postoperative frequency of surgical site infection was measured using redness, pain, raised local temperature and wound discharge as diagnostic criteria. Postoperative surgical site infection was measured using the above criteria scale on 3rd postoperative day and 15th postoperative day. The frequency of infection in the studied patients on day 3 and day 15 was calculated. P-value of ≤ 0.05 was considered as statistically significant.

Results: Out of total 400 patients, 290 were males and 110 were females, the age distribution was from 24 to 70 years. Mean age was 48.2± 10.8 SD. ESR for the patients ranged from 2 to 36 with a mean of 11±4.6. White cell count of the patients ranged from 2900 to 20100 with a mean of 7342±2100. Only 7 patients (1.7%) developed infection on third day of surgery and it persisted in only 4 patients (1%) till day 15 of surgery.

Conclusion: Single dose preoperative antibiotic is effective in postoperative wound infection prophylaxis. This protocol if followed can prevent drug resistance and multiple doses related side effects and can cut hospital cost.

Key words: Antibiotic prophylaxis, Infection, Intervertebral disc prolapse, Single dose antibiotics, Surgical site.

Author`s Contribution
[1] Conception, synthesis, planning of research and manuscript writing Interpretation and discussion
[2,3] Data analysis, interpretation and manuscript writing, [4] Active participation in data collection.

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Introduction

Disc prolapse is the most common cause of sciatica with lesions occurring most often at L4-L5 and L5-S1 segments.[1] Approximately 12–33% of the adult work force is affected by low back pain each year. [2] It has been suggested that between 70 - 95% of adults will suffer from low back pain at some time during their life time.[3] Unlike other orthopedic disorders, the expenses associated with management of back pain have increased over the last 20 to 30 years.[4] Despite continuous clinical and scientific efforts, low back pain remains an ever-present, quality-of-life-related, health problem.[5] The lumbar intervertebral disc is susceptible to injury and early degeneration, which often results in pain and disability.[6] To effectively cure these problems, treatment of symptomatic lumbar disc herniation has continuously evolved.[7] Surgeons have tried to reduce operative trauma to the spine by adopting minimally invasive techniques which are used to treat single-level disc injury in working-age adults.[8-10] Despite widespread use of this technique, there are few reports of long-term results.[11] Early success rates ranging from 70–91% have been reported.[12]

With proper patient selection, surgery for lumbar disc herniation and sciatica can be expected to lead to excellent results in the majority of patients.[13-15] Surgical site infection is one of the most common complications that a surgeon encounters, with an infection occurring after approximately 780,000 operations in the United States each year.[16] The use of antibiotic prophylaxis in orthopedic surgery has been shown to be beneficial.[17] The incidence of postoperative infections has been estimated at 0.7 to 11.9% of spinal operations.[18] Several factors are known to increase rates of postoperative infections in common procedures, such as spinal fusions and laminectomies, according to the National Nosocomial Infection Surveillance report. Instrumentation has been shown to increase the rate of infection to 3 to 6%, as has malnutrition, extended pre-surgical hospital stay, and increased blood loss.[19-21] Postoperative spinal wound infections are painful and can lead to poor cosmetic outcomes if allowed to heal by secondary intention.[22] The expense is considerable as well. The cost of medical care incurred during the course of a lumbar fusion, complicated by deep wound infection may be three or four times higher than the cost of an uncomplicated fusion.[23] Antibiotics should be administered within sixty minutes prior to the incision and, ideally, as near to the time of the incision as possible.[24] A single dose of antibiotics may be adequate for prophylaxis against perioperative infection.[25]

The objective of this study is to measure the frequency of wound infection following lumbar disc surgery in patients receiving a single dose of antibiotic prophylaxis. Decrease in frequency can lead to shorter hospital stay, fewer costs to the health care facilities, and lesser chances of antibiotic adverse reactions and resistance to antibiotic therapy, thus reducing costs and more free beds available to our overcrowded and overburdened health care system.

Patients and Methods

This cross-sectional study was conducted at the Department of Neurosurgery, Pakistan Institute of Medical Sciences Islamabad from March 2013 to February 2014. Sample size was calculated through WHO calculator with the 95% confidence level, 4.3% anticipated population proportion and 2% absolute precision. Calculated Sample size was 396 individuals.[7] Total four hundred patients, of both sexes, undergoing surgical intervention for lumbar disc surgeries and meeting inclusive and exclusive criteria were included in the study. All patients having prolapsed inter vertebral disc of either gender and of any age diagnosed on MRI scans having significant prolapsed intervertebral disc were included in the study. These patients were operated under same type of anesthesia and antibiotic protocol. The patients who had co morbid conditions including malnutrition, diabetes mellitus, end-stage renal disease, cirrhosis of liver, ischemic heart disease, those receiving immunosuppressant drugs, AIDS, patients with multiple level disc disease, patients with pre-operative symptoms and signs of any infection, patients with CSF leaks, patients undergoing re-exploration were excluded from the study.

The study was approved by hospital ethical committee. Informed consent was taken from the patient or guardian. The data on each of the patient was collected using pre-designed proforma. Each patient was given broad spectrum antibiotics i.e. inj. Ceftriaxone 1gm intravenous (third generation cephalosporins) as per study protocol. The surgery was performed by a consultant neurosurgeon. Each patient was examined for clinical features of infection on 3rd and 15th postoperative day. Clinically suspected cases were confirmed by local wound examination and complete blood picture with ESR.

The complication free patient was discharged on 3rd postoperative day and considered normal if no clinical features of infection appear till 15th postoperative day. Telephonic contact and address of the patient was taken to ensure follow up. Data was analyzed using SPSS version 12. Mean ± S.D were calculated for numerical variables. Frequencies and percentages were calculated for categorical variables.

Results

Out of 400 patients, 290 (72.5%) were males and 110 (27.5%) were females. Age range of the patients was 24 to 70 years.Highest number of patients were between the ages of 45 years to 54 years and lowest number of patients were between 24 years to 34 years. The ESR of the patients ranged between 2-36 mm/hour. The WBC counts ranged from 2900 to 20100 / cmm (Table 1). Infection status at day 3 and day 15 of surgery was obtained using the proforma charting and categorizing the patients according to their findings. At day 3, pain was present in large number of patients (29.75%) followed by raised temperature (21.25%), redness (16.25%) and discharge (3%). At day 5, frequency of these symptoms decreases. Pain was present in 3.75% patients followed by raised temperature (2%), discharge (1.5%) and redness (0.25%) (Table 2).

Table 1:Descriptive characteristics of study patients (n=400)

Variables	mean±SD	Median	Min	Max
Age of patients (years)	48.2±10.8	47	24	70
ESR (mm/hour)	11±4.6	11	2	36
WBC count (/cmm)	7342±2100	7100	2900	20100

Table 2: Frequency of clinical features in study participants at day 3 and day 15 (n=400)

	Day 3	Day 15
Variables	n(%)	n(%)
Redness		
Yes	65 (16.25)	1(0.25)
No	335 (83.75)	399(99.75)
Pain		
Yes	119 (29.75)	15(3.75)
No	281 (70.25)	385(96.25)
Raised Temperature		
Yes	85(21.25)	8(2)
No	315(78.75)	392(98)
Discharge		
Yes	12(3)	6(1.5)
No	388(97)	394(98.5)

Based upon these findings, at day 3, infection was declared in 7 patients (1.7%). Later on at day 15, infection was present only in 4 patients (1%). These patients were continued with their admission. Wound toilet and re suturing was done once the infection was cleared. Table 3 shows gender-wise status of patients at day 3 and day 15. Mean age of patients having infection at day 3 and day 15 was 44.3±8.1 and 46±7.2 years respectively. At day 15, mean ESR and WBC count were more 21.1±11 mm/hour and 13400±4390 /cmm respectively in patients suffering from infection, as compared to patients having no infection (Table 4).

Discussion

Surgical site infection is a devastating complication in spine surgeries.[1] It prolongs the duration of the hospital stay, increases medical expenditures, the likelihood of an intensive care unit stay, and the incidence of readmission as well as increases the risk of mortality and worsens the quality of life.[2] A vast majority of surgical infections can be preventable with appropriate interventions. Evidence-based practices resulted in three main focuses for antibiotic administration: appropriate selection of antibiotics, administration of antibiotics within 30-60 min before incision, and discontinuation of prophylactic antibiotics within 24 hours of surgery.[3-5]

Despite the knowledge about preventing infection and despite the progress of contemporary surgery, infection is still one of the most feared complications of a surgical procedure.[6-8] Perioperative antimicrobial prophylaxis has long been advocated in certain types of clean and clean-contaminated surgical procedures to decrease the incidence of surgical site infections (SSIs).[9-11] With Increasing health care costs, hospitals and clinics should review procedures to adjust their budgets. Concerns of

Table 3: Gender and age wise infection status of patients at day 3 and day 15 (n=400)

Variables	Day 3		Day 15	
	No infection	Infection present	No Infection	Infection present
	n (%)	n (%)	n (%)	n (%)
Gender				
Male	284 (71)	6 (1.5)	287(71.75)	3(0.75)
Female	109 (27.25)	1(1.25)	109(27.25)	1(0.25)

Table 4: Laboratory findings of patients receiving a single dose of antibiotic therapy at day 15 (n=400)		
Variables	No infection	Infection present
	mean±SD	**mean±SD**
ESR (mm/hour)	10.9±4.1	21.1±11
WBC count (/cmm)	7300±1800	13400±4390

antimicrobial resistance puts pressure on infection control specialists to decrease antimicrobial usage.[12-15]

The “ideal” antibiotic for prophylaxis of wound infections in clean surgery should have a relatively low cost, limited toxicity, long half-life in both serum and bone, adequate penetration in subcutaneous and muscular tissues and intervertebral disc, and should be sufficiently broad to be effective but limited enough to avoid resistance and superinfections.[21] Gram-positive Staphylococci are the most common causative pathogens for postoperative infections.[22] A first-generation cephalosporin is the most widely accepted choice in spinal surgery because it is active against staphylococcal species, is relatively nontoxic and inexpensive, and it provides good soft tissue and bone penetration. Also, first generation cephalosporin has been proved to be more cost-beneficial compared with other wide-spectrum antibiotics such as Ampicilin-sulbactam.[23]

Ceftriaxone was the suggested prophylactic antibiotic in our hospital. Average savings per patient in my study was approximately Rs 5000. The remarkable decrease in antibiotic use and costs per procedure was due to no requirement for post-operative doses, in countries with limited resources such as Pakistan; even relatively modest savings can have an impact. Anderson PA et al [8] conducted a study to provide a narrative review of practical solutions to reduce SSI (surgical site infection) in spine surgery. SSI prevention starts with proper patient selection and optimization of medical conditions, particularly reducing smoking and glycemic control. Screening for staphylococcus organisms and subsequent decolonization is a promising method to reduce endogenous bacterial burden. Preoperative warming of patients and timely administration of antibiotics are critical to prevent SSI. Radcliff XE et al [21] conducted a study to identify and summarize the recent literature on the incidence, risk factors, diagnosis, prevention, and treatment of SSIs after adult spine surgery. They concluded that there are a number of patient and procedure-specific risk factors for SSI. Surgical site infection appears to have significant implications from the patients' perspective on outcome of care. Diagnosis of SSI appears to rely primarily on clinical factors, while laboratory values such as C-reactive protein are not universally sensitive. Similarly, novel methods of perioperative infection prophylaxis such as local antibiotic administration appear to be modestly effective. This study also signifies the importance of single dose of antibiotic in controlling the infection rate.

Conclusion

This study proves that single dose antibiotic is enough for postoperative lumbar wound infection prophylaxis. Wound infection must be prevented not managed with multiple dose regimens. These results are comparable to international studies. The choice of antibiotic may vary from hospital to hospital and region to region.

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