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Egyptian Journal of Neurosurgery (2022) 37:5
https://doi.org/10.1186/s41984-022-00143-3

Egyptian Journal of Neurosurgery

RESEARCH Open Access

Role of intra-discal Vancomycin instillation in prevention post-operative discitis

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Abstract

Background: Post discectomy discitis is regarded as the most disabling cause of failed back surgery. Value of local intra-operative application of antibiotics in prevention of such complication has been a matter of debate. We evaluate the role of intraoperative intra-discal vancomycin powder instillation as a prophylaxis in prevention of postoperative discitis in patients undergoing microscopic discectomy. We allocated 100 patients undergoing discectomy equally into two groups. In the first group, a local Vancomycin powder was inserted into the disc space after finishing discectomy, and in the second group, nothing was inserted.

Results: The postoperative discitis was reported in 6 cases; of them, two patients were in the Vancomycin group (4%), while four patients were in the non-Vancomycin group (8%).

Conclusions: We concluded that the intra-operative prophylaxis, with intra-discal Vancomycin, decreased the incidence of postoperative discitis but without significant statistical difference. We advocate using local vancomycin especially in high risk patients for prevention of post discectomy discitis.

Keywords: Lumber discectomy, Discitis, Vancomycin, Prevention

Introduction

Postoperative discitis is defined as the infection of the nucleus pulposus that occurs after lumbar discectomy. Secondary involvement of the cartilaginous endplate and vertebral body is defined as spondylodiscitis [1].

It is considered as type of deep infections and was first described by Turnbull in 1953 [2]. With incidence varies from 0.2 to 4%, it represents a rare complication which requires long-term treatment and may cause failure of back surgery and post-operative disability [3, 4].

Post-operative discitis caused mostly by nosocomial infections mostly via direct inoculation by surgical tools, but in few cases the source of infection was unknown which is defined as aseptic discitis [5]. The most common causative agent of discitis is Staphylococcus; followed by aerobic Gram negative bacilli, while clostridium perfringens, Haemophilus species, and Aspergillus fumigatus are rare agents [1].

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There are many risk factors that could increase the possibility of postoperative discitis such as old age, obesity, immune-compromised patient, diabetes mellitus, smoking, systemic and/or local skin infection at the time of surgery [6, 7].

Clinical symptoms include low backache usually of sever intensity, muscle spasm and in some cases radiculopathies. These clinical symptoms after disc surgery are best evaluated by MRI as it can demonstrate involvement of disc space and vertebral bodies, also it can rule out surrounding soft tissue infection as paravertebral or epidural spinal abscess [8].

The intervertebral disc is a highly avascular structure. Solutes transport from the intracellular space into the nucleus pulpous by passive diffusion; depending on the permeability of the adjacent endplate and nucleus pulposus [9, 10]. The major factor of permeability is the antibiotic charge. The positively charged antibiotics as Gentamycin and Vancomycin can enter the disc, but negativity charged antibiotics as, Penicillin hardly penetrate, due to the mutually dependent charges [11, 12].

Different authors stated that adding local Vancomycin powder, showed a reduction in post-surgical site infection (SSI) requiring repeated surgery with large cost savings [6, 13, 14]. Other authors stated that this was not associated with a significant decrease in the incidence of SSIs after posterior spinal surgeries [15].

This current prospective, comparative study aims to evaluate the role of intraoperative intra-discal Vancomycin powder instillation as a prophylaxis in prevention of postoperative discitis in patients undergoing open or microscopic discectomy.

Methods

This is a prospective, comparative study conducted at Zagazig university hospital in the period from 2018 to 2020.

The study protocol was formally reviewed and approved by the ethics committee for human research at Faculty of Medicine, Zagazig University.

Inclusion criteria: hundred patients of both sexes and above 18 years old with lumbar disc prolapsed diagnosed by CT and/or MRI with failure through conservative treatment and indicated for surgery by clinical and radiological means.

Exclusion criteria: patients were excluded if had previous history of spine infection, intra operative incidental durotomy, immune compromised patients with systemic infection at time of surgery, allergic to Vancomycin and/or had received systemic Vancomycin peri-operatively.

The patients were allocated to two equal groups' fifty patients each. We allocated patients on base of "day of the week"; patients who were operated on Sundays and Tuesdays were allocated to group A, while who were operated on Mondays and Wednesdays were allocated to group B. This is called a "quasirandomization" [16].

Patient were randomized on base of Group A received approximately 0.5 g intradiscal Vancomycin powder that was inserted after discectomy by using a bone graft funnel, while Group B, nothing was inserted in the disc space. Patients in group A were tested for vancomycin allergy before receiving the drug. All patients received intravenous pre-operative antibiotic in the form of 1 g Cephazolin one hour before the surgery, and another two doses post-operatively, 12 h apart [17]. All surgeries were performed under general anesthesia, using microscopic tubular discectomy and most of patients were discharged the next day.

Patients were observed postoperatively on day 1 then, weekly for the first two weeks, then on the sixth week. Postoperative discitis was suspected if a new-onset or a persistent backache, thigh pain, back muscle spasm, fever, and radiculopathy occurred. Laboratory investigations included ESR, WBC, CRP-titer were done for suspected cases. A Contrast MRI study was also done; we depended on clinical presentation, laboratory results, and MRI findings for diagnosis.

Risk factors like diabetes, obesity, smoking, and previous lumbar surgeries were noted, also intra-operative data such as operation time, amount of blood loss and level of surgery were also recorded for all patients.

Results

There was no statistical significance difference between the studied groups in age, sex distribution or risk factors (Table 1).

There was no statistical significance difference between the studied groups in operation time, blood loss or operated level. There was an increase in frequency of postoperative discitis among group II compared to group I but without statistical significant difference. Also there was no statistical significance difference between the studied groups in symptoms, time of presentation or laboratory findings of discitis cases (Table 2). In the current study, we had 6 patients in both groups (2 cases [4%] in group A and 4 cases [8%] in group B) who developed postoperative discitis.

All cases diagnosed with discitis received conservative treatment. We had no revision surgery in our study.

Discussion

In the present study, the rate of disc prolapse was more common in males (51%) than in females (49%) with no significant difference found between the two groups. The operated lumbar spine levels were L1–L2, L2–L3, L3–L4, L4–L5, and L5-S1, with 73% of patients between L4–L5 and L5-S1 in both groups.

Jordon et al. [18] mentioned that the L4-5 and L5-S1 procedures account for about 95% of lumbar surgeries. The lordotic angle and hypermobile segments between L4-S1 might be the cause.

There are some risk factors (diabetes, obesity, smoking, and steroid therapy) for the development of postoperative discitis (Table 1) in our study, with a non-significant P-value between the two groups. That was consistent with risk factors previously mentioned in literature [19].

Piotrowski et al. found that 26% of patients with postoperative discitis were diabetics. The incidence of diabetes in surgical patients was 6.8% [20].

In the current study, we had 6 patients in both groups (2 cases [4%] in group A and 4 cases [8%] in group B) who developed postoperative discitis.

This came in agreement with Hasan et al. [6] who found that postoperative discitis was developed in 1.4% in the Vancomycin group, and 5.56% in the non-Vancomycin group.

Table 1 Basic characteristics of the studied groups

Variable	Group I Vancomycin ($n=50$)		Group II No vancomycin ($n=50$)		t	P
Age: (years)						
Mean ± SD	49.02 ± 12.63		50.7 ± 12.39		0.67	0.50
Range	27–68		27–68			NS
Variable	**No**	**%**	**No**	**%**	χ^2	P
Sex						
Female	26	52	23	46	0.36	0.55
Male	24	48	27	54		NS
Risk factor						
Diabetes	11	22	13	26	0.22	0.64 NS
Obesity	18	36	16	32	0.18	0.67 NS
Smoking	8	16	11	22	0.59	0.44 NS
Steroid use	4	8	3	6	Fisher	0.99 NS
Prior lumbar surgery	9	18	11	22	0.25	0.62 NS

This table shows that there was no statistical significance difference between the studied groups in age, sex distribution or risk factors

SD: Stander deviation, t: independent t test, χ^2: chi square test, Fisher: fisher exact test

NS: Non significant ($P>0.05$)

Other local antibiotics was studied, Gentamycin was used intradiscally and was found to be effective in decreasing the postoperative discitis [21].

In our study, all of our patients who developed post-operative discitis were shown to have elevated WBC count, ESR, and CRP.

Patients with post-operative discitis were shown to have elevated WBC count (range between 11,000 and 22,000 × 103), ESR (range between 66 and 90), and CRP (range between 11 and 32). The CRP is the most sensitive test for post-operative discitis, as reviewed in previous studies, and the level returns 10 days after surgery, so any increase in its level two weeks postoperatively is suggestive of postoperative discitis [6, 22, 23].

We correlate the data of clinical symptoms, signs, laboratory inflammatory markers, and MRI results to establish the diagnosis of discitis.

Studies on the penetration of positively charged Vancomycin into the nucleus pulposus of rabbits showed that they reached peak concentration at 2 h and remained at peak levels for at least 6 h with adequate antimicrobial levels against both gram positive and gram negative microorganisms. These levels had a major role to decrease post-operative infection with local application of Vancomycin [24–26].

In their meta-analysis on local intra-operative use of Vancomycin, Tailaiti et al. stated that post-operative discitis incidence can be significantly reduced by intra-wound application of Vancomycin in most circumstances. This method can be applied in various spinal procedures involving instrumentation [27].

Dodson et al. on their systematic review showed that intra-wound Vancomycin powder is protective against surgical site infection. However, it is less clear if this treatment increases the risk of gram-negative infection [23].

Focusing on staph infections, Heller et al. found that the addition of intrawound vancomycin powder to our antimicrobial prophylaxis regimen has decreased the rate of staphylococcal SSIs in their posterior instrumented arthrodesis surgeries [28].

We may indicate that other modifiable factors to decrease pot discectomy discitis have also been reported in literatures. These include meticulous hemostasis and wound closure, the use of appropriate antibiotics 30–60 min before incision, effective closure of durotomies and pseudomeningocele avoidance, reduced operating room traffic, accelerated operative times, use of intraoperative irrigation, and use of minimally invasive approaches when appropriate [29, 30].

Limitations of studyLimitations of study

We did not include the causative organism of discitis in this study. Also, our study did not include the effect of local vancomycin on spine fusion and the effects on a variety of cell types, including fibroblasts and osteoblasts. We also recommend future studies with larger sample

Table 2 Operative and post operative data of the studied groups

Variable	Group I	Group II	t	P
	Vancomycin ($n=50$)	No vancomycin ($n=50$)		
Operation time				
Mean ± SD	85.5 ± 9.02	87.08 ± 9.61	0.85	0.40
Range	70–106	70–110		NS
Blood loss				
Mean ± SD	80.22 ± 26.94	78.68 ± 29.14	0.27	0.78
Range	40–190	40–200		NS

Variable	No	%	No	%	Test	P
Level						
L1-2	4	8	2	4		
L2-3	4	8	3	6		
L3-4	6	16	8	16	Yates	0.82
L4-5	25	50	23	46		NS
L5-S1	11	22	14	28		
Post-operative discitis						
No	48	96	46	92	Fisher	0.68
Yes	2	4	4	8		NS
Symptoms						
Backache	2	4	4	8	Fisher	0.68 NS
Spasm	2	4	4	8	Fisher	0.68 NS
Pain	1	2	3	6	Fisher	0.62 NS
Radiculopathy	1	2	2	4	Fisher	0.99 NS
Time: Mean ± SD	12 ± 5.66	13.75 ± 5.44	$t=0.37$	0.73 NS		
Lab:			t			
ESR: Mean ± SD	82.5 ± 9.95	80 ± 9.83	0.33	0.76 NS		
CRP Mean ± SD	34 ± 4.24	38.25 ± 4.11	1.18	0.30 NS		
WBCs: Mean ± SD	17.5 ± 1.13	17.1 ± 1.41	0.34	0.75 NS		

This table shows that there was no statistical significance difference between the studied groups in operation time, blood loss or level. There was an increase in frequency of post-operative discitis among Group II compared to Group I but without statistical significance difference. Also there was no statistical significance difference between the studied groups in symptoms, time of presentation or laboratory findings of discitis cases

SD: Stander deviation, t: independent t test, χ^2: Chi square test, Fisher: Fisher exact test

Yates: Yates correction chi square test, NS: Non significant ($P>0.05$)

size for further assessment of the statistical significance of local Vancomycin application in spine surgery.

Conclusions

We concluded that the intra-operative prophylaxis, with intra-discal Vancomycin, decreased the incidence of postoperative discitis but without significant statistical difference. We advocate using local vancomycin especially in high risk patients for prevention of post discectomy discitis.

Abbreviations

SSI: Surgical site infection; MRI: Magnetic resonant image; CT: Computed topography.

Acknowledgements

Not applicable.

Authors' contributions

AA has participated in performing surgical procedures, helped in writing and reviewing manuscript and data collection. MM has participated in performing surgical procedures, MS participated in performing surgical procedure and helped in writing and reviewing manuscript and data collection. All authors read and approved the final manuscript.

Funding

The authors received no funding for this work.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was formally reviewed and approved by the ethics committee for human research at Faculty of Medicine, Zagazig University.

Consent for publication

Not applicable.

Competing interests

The authors declare there are no competing interests.

Received: 22 September 2021 Accepted: 1 January 2022
Published online: 14 February 2022

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