

Article

Post-Laminectomy Wound Infections: Colonized Seromas Mimicking Wound Infections

Burke A. Cunha ^{1,2,*}, Eileen D. Abruzzo ^{1,2} and Paul E. Schoch ^{1,2}

¹ Infection Control Department, Clinical Microbiology Laboratory and Infectious Disease Division, Winthrop-University Hospital, Mineola, NY 11051, USA;

E-Mails: eabruzzo@winthrop.org (E.D.A.); pschoch@winthrop.org (P.E.S.)

² School of Medicine, State University of New York, Stony Brook, NY 11051, USA

* Author to whom correspondence should be addressed; E-Mail: bacunha@winthrop.org;

Tel.: +516-663-2505; Fax: +516-663-2753.

Received: 1 December 2013; in revised form: 8 January 2014 / Accepted: 20 January 2014 /

Published: 14 February 2014

Abstract: Objective: Post-operative laminectomy wounds are frequently accompanied by seromas. Post-operative wound drainage may be colonized or infected. The differentiation of wound colonization from infection is difficult for non-infectious disease physicians. Methods: External chart reviewers classified 31/1531 laminectomies (over three years) as post-operative wound infections. We re-evaluated these cases using infectious disease criteria, *i.e.*, while pathogens may be cultured from both colonized and infected wounds, only wound infections have a purulent discharge with abundant white blood cells (WBCs) on Gram stain. Colonized wounds have positive wound cultures but no/few WBCs on Gram stain. Results: We found only 11/31 actual wound infections, the remainder were not *bona fide* wound infections, but were colonized seromas. Conclusion: Post-laminectomy colonized seromas that are culture positive for one or more organisms often mimic wound infections. In the era of public reporting of nosocomial infections, it is important that external reviewers differentiate colonization from infection to provide regulatory agencies with accurate data.

Keywords: mimics of wound infections; colonized seromas; post-operative fever; prophylactic antibiotics; wound colonization vs. infection

1. Introduction

Laminectomies are among the most complicated orthopedic/neurosurgical procedures. Complicated surgical spine procedures are technically difficult and are of long duration which increases the potential for infectious complications, *i.e.*, deep wound infections [1–4]. Post-operative laminectomy wound infections may be due to several procedure related factors, *e.g.*, procedure duration/complexity and may be due to host related factors, *e.g.*, age, weight, diabetes and host defense status. With a good aseptic surgical technique, prophylactic antibiotics are given to minimize post operative wound infections [5–9]. We became interested in clinically differentiating colonized from infected seromas, which are a particular problem in post-laminectomy surgery, to avoid needless antibiotic therapy and to accurately classify these wounds.

2. Materials and Methods

During the past three years (2010–2012) a total of 1531 laminectomies were performed in our 600 bed university-affiliated teaching hospital. Non-infection control (IC) and non-infectious disease (ID) external chart reviewers reported a relatively high incidence of wound infections post-laminectomy. Since the number of cases seemed unusually high, we re-reviewed 31 cases classified as post-laminectomy wound infections to determine the number of actual infections. In our review, the duration of the case, age, weight, comorbidities, history of previous infections, individual surgeons, laminectomy location and pre-operative antibiotic regimens were analyzed. In addition, microbiological data were correlated with the clinical findings and pre-operative antibiotic regimens.

3. Results

Thirty one potential post-laminectomy wound infections identified over a three year period were reviewed; of these only 11 cases met infectious disease criteria for wound infections (Table 1) [10]. Among the 11 post-laminectomy wound infections, we found no procedure or individual surgeon related common denominators. Furthermore, a variety of wound isolates were identified; *Klebsiella pneumoniae*, methicillin resistant *Staphylococcus aureus* (MRSA), methicillin sensitive *Staphylococcus aureus* (MSSA), coagulase negative staphylococci (CoNS), and *E. coli*. There was no relationship between the spectrum of the prophylactic antibiotics used and organism cultured from colonized or infected wounds (Tables 2–4).

Table 1. Winthrop-university hospital, recent experience with potential post-laminectomy wound infections.

Year	Total Cases (1531)	Presumed Wound Infections (31)	Verified Wound Infections (11/31)	Colonized Seromas Not Wound Infections (20/31)
2010	562	1	0	1
2011	530	16	7	9
2012	439	14	4	10

Table 2. Potential post-laminectomy wound infections (2010–2012).

Wound Infections Cellulitis/Abscess (11/31)	Non-Wound Infections Seromas (20/31)
Pre-Operative Prophylactic Antibiotics	
Cefazolin 8/11 (73%) Clindamycin 1/11 (9%) Vancomycin 1/11 (9%) (plus gentamicin) Unknown 1/11 (9%)	Cefazolin 16/20 (80%) Clindamycin 3/20 (15%) Vancomycin 0/20 (0%) Unknown 1/20 (5%)
The Relationship between Pre-Operative Antibiotics and Post-Operative Wound Cultures	
<p>Cefazolin (8/11) associated isolates *: MSSA = 3 MRSA = 2 <i>M. fortuitum</i> = 1 Unknown = 2</p> <p>Clindamycin associated isolates: <i>E. coli</i> = 7</p> <p>Vancomycin (1/11) (plus gentamicin) associated isolates: <i>K. pneumoniae</i> = 2</p>	<p>Cefazolin associated isolates *: CoNS = 6 MSSA = 1 VSE = 1 <i>E. coli</i> = 2 <i>Proteus</i> sp. = 1 Unknown = 2 Culture negative = 7</p> <p>Clindamycin associated isolates: CoNS = 2 Culture negative = 2</p>

* Some cases had multiple isolates; MSSA = methicillin sensitive *Staphylococcus aureus*; MRSA = methicillin resistant *Staphylococcus aureus*; VRE = vancomycin resistant enterococci; CoNS = coagulase negative staphylococci.

Table 3. Differential diagnostic features of post-operative laminectomy wounds: colonization vs. infection *.

Wound Discharge	Wound Gram Stain	Wound Culture	Infectious Disease Diagnosis
Clear	with None, few or some WBCs	with + →	Colonization
Serous	with Few or some WBCs	with + →	Colonization
Serosanguineous	with Few or some WBCs	with + →	Colonization
Purulent	with None, few, or some WBCs	with + →	Inflammation
Purulent	with Abundant WBCs	with + →	Infection

* Any post-operative patient may have fever, leukocytosis, wound erythema/induration not related to wound infection. WBCs = white blood cells.

Table 4. Skin/Wound organisms that should be considered as commensals/colonizers †.

Gram Positive Organisms	Other Organisms	Gram Negative Organisms
Non-Purulent Wound Exudate with a Gram Stain with WBCs		
<i>Corynebacterium</i> sp.	Atypical mycobacteria	<i>Burkholderia cepacia</i>
<i>Propionibacterium</i> sp.		<i>Stenotrophomonas maltophilia</i>
<i>Bacillus</i> sp.		<i>Citrobacter</i> sp.
Group D enterococci (VSE/VRE)		<i>Acinetobacter</i> sp.
Viridans streptococci		<i>Alcaligenes xyloxidans</i>
Coagulase negative staphylococci (CoNS)		<i>P. aeruginosa</i> †
MRSA †		<i>Klebsiella</i> sp. †
MSSA †		<i>Enterobacter</i> sp. †
		<i>Serratia marcescens</i> †
		<i>Proteus</i> sp.

† Considered a *bona fide* infection only if a purulent wound exudate has abundant WBCs on Gram stain.

4. Discussion

Skin colonization is the rule in the microbial milieu of the hospital. Seromas are common post-laminectomy and positive wound or seroma cultures often represent colonization by skin organisms. Non-infection control and non-infectious disease external chart reviewers, who evaluated 31 patients, were often confused by discordant seroma fluid microbiology results, *i.e.*, Gram stain (number of white blood cells (WBCs) and organisms) and wound/fluid culture results.

The most common cause of misdiagnosis of post-operative laminectomy wound infections was colonized seromas. External chart reviewers (non-infection control and non-infectious disease personnel) had difficulties in correlating clinical and microbiologic data to diagnose or rule out post-laminectomy wound infections. Post-operatively, the skin surrounding incisions may be erythematous, but unless infected is not warm or tender. Furthermore, unlike non-laminectomy post-operative wound infections, laminectomies were commonly complicated by seromas. Colonized seromas draining through the wound may mimic wound infection, but seroma fluid is clear or serosanguineous, but not purulent.

Colonization of wounds and seromas is common but is not preventable by utilizing pre-operative prophylactic antibiotics. Wound Gram stains demonstrating few/no polymorphonuclear cells (PMNs) with positive wound cultures from a body fluid without the clinical criteria of infection are not indicative of wound infection. When the signs of infection are absent, *e.g.*, no surrounding skin erythema, warmth and tenderness, microorganisms cultured from non-purulent seroma fluid indicate colonization but not infection.

5. Conclusions

Fever also caused diagnostic confusion for external reviewers in attributing fever/leukocytosis in post-laminectomy patients with positive wound cultures to wound infection. However, post-laminectomy patients often have low-grade fevers due to a variety of other non-wound related infectious or non-infectious causes, *e.g.*, inflammation, atelectasis, phlebitis. In our experience, external chart reviewers have difficulty in interpreting and correlating wound cultures results with

microbiologic results, *i.e.*, wound culture *vs.* wound Gram stains to differentiate post-laminectomy wound infections from colonized seromas.

Conflicts of Interest

All authors declare no conflict of interest.

References

1. Anderson, D.J.; Kaye, K.S.; Classen, D.; Arias, K.M.; Podgorny, K.; Burstin, H.; Calfee, D.P.; Coffin, S.E.; Dubberke, E.R.; Fraser, V.; *et al.* Strategies to prevent surgical site infections in acute care hospitals. *Infect. Control Hosp. Epidemiol.* **2008**, *39*, 51–61.
2. Classen, D.C.; Evans, R.S.; Pestotnik, S.L.; Horn, S.D.; Menlove, R.L.; Burke, J.P. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *N. Engl. J. Med.* **1992**, *325*, 281–286.
3. Fehlings, M.G.; Smith, J.S.; Kopjar, B.; Arnold, P.M.; Yoon, S.T.; Vaccaro, A.R.; Brodke, D.S.; Janssen, M.E.; Chapman, J.R.; Sasso, R.C.; *et al.* Perioperative and delayed complications associated with the surgical treatment of cervical spondylotic myelopathy based on 302 patients from the AOSpine North America Cervical Spondylotic Myelopathy Study. *J. Neurosurg.* **2012**, *16*, 425–432.
4. Furlan, J.C.; Kalsi-Ryan, S.; Kailaya-Vasan, A.; Massicotte, E.M.; Fehlings, M.G. Functional and clinical outcomes following surgical treatment in patients with cervical spondylotic myelopathy: A prospective study of 81 cases. *J. Neurosurg.* **2011**, *14*, 348–355.
5. Horan, T.C.; Andrus, M.; Dudeck, M.A. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *Am. J. Infect. Control* **2008**, *36*, 309–332.
6. Kuo, C.H.; Wang, S.T.; Yu, W.K.; Chang, M.C.; Liu, C.L.; Chen, T.H. Postoperative spinal deep wound infection: A six-year review of 3230 selective procedures. *J. Chin. Med. Assoc.* **2004**, *67*, 398–402.
7. Mangram, A.J.; Horan, T.C.; Peason, M.L.; Silver, L.C.; Jarvis, W.R.; Hospital Infection Control Practices Advisory Committee. Guidelines for prevention of surgical site infection, 1999. *Infect. Control Hosp. Epidemiol.* **1999**, *20*, 247–278.
8. Al, M.; Babu, R.; Karikari, I.O.; Grunch, B.; Agarwal, V.J.; Owens, T.R.; Friedman, A.H.; Bagley, C.A.; Gottfried, O.N. 2012 Young Investigator Award winner: The distribution of body mass as a significant risk factor for lumbar spinal fusion postoperative infections. *Spine* **2012**, *37*, 1652–1656.
9. Molinari, R.W.; Khera, O.A.; Molinari, W.J., III. Prophylactic intraoperative powdered vancomycin and postoperative deep spinal wound infection: 1512 Consecutive surgical cases over a 6-year period. *Eur. Spine J.* **2012**, *4*, 476–482.

10. Mayhall, C.G. Surgical Site Infections. In *Hospital Epidemiology and Infection Control*, 4th ed.; Lippincott Williams & Wilkins: Philadelphia, PA, USA, 2012; pp. 286–306.

© 2014 by the authors; licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/3.0/>).