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Diagnostic Value of Surgical Wound Cultures in Osteomyelitis

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Objective: To detect reliability of cultures from discharging surgical bone wounds when compared with operative specimens.

Setting: Basrah University Teaching Hospital, Iraq.

Design: A prospective study.

Methods: Surgical wound cultures from operative specimens in 42 patients with bone infection were compared with 81 operative isolates.

Results: Seventy five (92.6%) operative isolates were recovered in the wound cultures, showing a specificity of 91.2% and a predictive value of 81.5%.

Conclusion: A specimen, from discharging surgical wound proved to be a reliable source for isolation of all bacteria causing bone infection except Pseudomonas aeruginosa and coagulase-negative staphylococci because these organisms were found as frequent contaminant of surgical wounds.

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Purulent discharge may develop from surgical wound in patient with underlying bone infection. A persistent profuse wound discharge may indicate failure of antibiotic therapy or may indicate bone infection resulting from an operative procedure (postoperative osteomyelitis). Many authors have used wound cultures to isolate the causative agents of osteomyelitis[1-4], but others consider it to be unreliable[5,6]. A direct bone sample from the depths of the infected site is an alternative, but this usually requires surgery under anaesthesia.

Surgical wound culture can be used for follow up of the patient and for detecting the emergence of antimicrobial resistance during long term antibiotic therapy. It is also used when operative specimen is missed or not obtained during surgery. It can be used before surgical exploration in cases of acute (early) postoperative osteomyelitis in which the patient need urgent antibiotic therapy according to culture and susceptibility test.

The aim of this study was to evaluate the reliability of surgical wound cultures in demonstrating the causative agents of osteomyelitis.

METHODS

During the period from February 1995 to March 1997 surgical wound cultures were compared prospectively with those of operative specimens from 42 patients with bone infection. The type of bone infection was: §haematogenous[15], postoperative[15], §§exogenous[8] and tuberculous[4]. Cases with clinical, radiological, histopathological and bacteriological evidence of bone infection were only included in this study. Prior antibiotics were given for all patients with pyogenic osteomyelitis (38 cases) before collection of operative and wound specimens. Four tuberculous cases were not on antibiotic therapy at the time of specimen collection.

The operative specimens were obtained directly from the infected bone or accumulated material in the soft tissues during operations. Other specimens were collected from surgical wounds within 1-7 days after surgery. Surgical wound specimens were also taken before operative exploration from cases of acute (early) postoperative osteomyelitis. The wound specimens were only obtained from cases with signs of infection (discharging wounds). Cases of dry healthy wounds without discharge were not included in this study. In case of profuse discharge the wound specimen was collected in a syringe by inserting its nozzle, without needle, into the wound and aspirating the liquid discharge. Only when the wound had a scanty discharge, the specimen was taken with a cotton-tipped swab.

Both the operative and wound specimens were inoculated on to the culture media immediately; neither using transport media nor delayed inoculation. Aerobic and anaerobic routine cultures were made from all 42 patients; and myocardial cultures were made on Lowenstein-Jensen media from four patients suspected to have tuberculous infection.

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§ Acute haematogenous osteomyelitis in children
§§ Chronic osteomyelitis resulted from previous compound fractures.

Table 1: Correlation of surgical wound cultures with operative cultures

Micro-organism	Total No. of cases	Cases with positive operative cultures	Total No of isolates	No. of operative isolates	No.agreeing with operative cultures	False negative	False positive	Sens-tivity (%)	Speci-ficity (%)	Predictive value (%)
Staphylococcus aureus	25	25	25	25	23	2	0	92	100	100
Coagulase-native staph	6	0	6	0	0	0	6*	–	85.7	0
Streptococcus species	7	7	7	7	7	0	0	100	100	100
Pseudomonas aeruginosa	7	3	7	3	2	1	4	66.7	89.7	33.3
Enterobacteriaceae	21	17	25	20	17	3	5	85	84.4	77.3
Anaerobic bacteria	13	11	28	26	26	0	2	100	93.5	92.8
Mycobacteria	4	0	0	0	–	0	0	–	100	–
Total	–	–	98	81	75	6	17	92.6	91.2	81.5

** Two isolates contaminated the surgical wounds in two Tuberculous cases*

Aerobic culture was made on the following media: 5% sheep blood agar, chocolate agar under 5% CO_2, MacConkey's agar and phenylethanol blood agar. Anaerobic culture was made on the following media: 5% sheep blood agar, phenylethanol blood agar, Bacteroides Bilr Esculin agar and vitamin K1-enriched Brucella lacked blood agar. Gaspak Jar (BBL) was used for anaerobic cultivation[7].

For statistical purposes the following definitions[8] were used:

Sensitivity was the number of wound isolates agreeing with operative cultures divided by the number of operative isolates; Specificity was the number of patients with negative results by both operative and wound cultures divided by the number of patients with negative results from operative cultures; and predictive value was the number of wound isolates agreeing with operative cultures divided by the total number of wound isolates.

RESULTS

All operative specimens had positive cultures except 4 tuberculous cases. Wound cultures were negative in 5 cases (2 tuberculous cases and 3 pyogenic cases). The operative cultures were monomicrobial in 23 cases and polymicrobial in 15 cases.

There were 81 isolates from the operative cultures (Table 1), of which 75 (92.6%) isolates were recovered in the wound cultures (sensitivity). Six isolates (from 6 patients) were identified in the operative cultures but not in the wound cultures (false-negative cultures). Seventeen isolates (from 14 patients) were identified in the wound cultures but not in the operative cultures (false-positive cultures). The specificity of wound culture was 91.2% and their predictive value was 81.5%.

There was a high level of agreement between the wound culture and the operative culture for all bacteria except Pseudomonas aeruginosa and coagulase-negative staphylococci. For these 2 organisms there was a high number of false-positive cultures (Table 1).

The operative and the wound cultures were identical in 6 (26%) of 23 cotton-swab wound specimens and 19 (100%) of 19 syringe-aspirated wound specimens.

Wound cultures of immediate and delayed specimen inoculations from the same patients were compared with operative cultures (Table 2). The immediate inoculation cultures had higher sensitivity and predictive value than the delayed ones.

Table 2: Comparison between wound cultures of immediate and delayed (for 6 hours) inoculations in the same patients related to operative cultures

	Cultures			
			Wound	
No. of patients	Total number of isolates	Operative	Immediate	Delayed
13	30	22		
Number agreeing with opeative cultures			20	9
False-negative			2	13*
False-positive			8	6
Sensitivity (%)			90.9	40.9
Specificity (%)			84.6	88
Predictive value ((%)			71.4	60

** Seven anaerobic organisms were not isolated by delayed inoculation cultures*

Cultures from immediate wound specimen inoculations without using transport media had a higher sensitivity, specificity and predictive value than cultures of specimens which were put into transport media for 6 hours before inoculation on plate media (Table 3).

Table 3: Comparison between wound cultures of immediate specimen inoculations without using transport media and delayed (for 6 hours) specimen inoculations by using transport media in the same patients related to operative cultures

	Cultures			
			Wound	
No. of patients	Total number of isolates	Operative	Immediate without transport media	Delayed with transport media
12	21	13		
Number agreeing with opeative cultures			11	8
False-negative			2	5
False-positive			3	8
Sensitivity (%)			84.6	61.5
Specificity (%)			93.6	83
Predictive value (%)			78.6	50

DISCUSSION

This study shows that culture of discharging surgical wound while the patient is on antibiotic therapy is a reliable method for isolation of all bacteria causing bone infection except

for Pseudomonas aeruginosa and coagulase-negative staphylococci. This is because these two organisms are members of the normal skin flora[9] which can easily contaminate the surgical wounds. Pseudomonas aeruginosa may also be unaffected by the antibiotics of common use for osteomyelitis, thus can colonize surgical wounds. It is also highly resistant to antiseptics that could be transmitted from patient to another by faulty dressing technique or by non-sterile instruments. Prior antibiotics that were given to the patients, seen to have little influence on the efficacy of discharging wound cultures.

The high rate of recovery of contaminant organisms from surgical wounds (33.3% of cases) is a misleading factor that can cause difficulty in interpretation of the true infecting organism(s). However Pseudomonas aeruginosa, coagulase-negative staphylococci and Enterobacteriaceae were commonly recovered as contaminants. Therefore, they can be excluded as causative pathogens if they are isolated from wound cultures in concomitant with Staphylococcus aureus in the cases of haematogenous osteomyelitis. The exclusion can also be easily made when positive operative culture is already made.

The surgical wound cultures revealed sensitivity of 92.6%, specificity of 91.2% and predictive value of 81.5%. Ferry et al[3] reported that same pathogens were grown on operative and wound cultures in 90% of the cases of monomicrobial bone infections.

The syringe-aspirated wound specimen yielded more accurate cultures than cotton-swab wound specimens. However, syringe-aspirated specimens were collected from wounds with profuse discharge, a situation which might lead to more accurate cultures. While the cotton-swab specimens were collected from wounds with scanty discharge, a situation which might reduce the accuracy of wound cultures. Mousa[10] had also found that syringe-aspirated sinus cultures were more accurate than cotton-swab sinus cultures; and active flowing sinus cultures were more accurate than cultures from dry sinuses.

This study confirmed that cultures of immediate specimen inoculation were more accurate than cultures of delayed inoculation and than cultures of specimens which were put into transport media with delayed inoculation. Delayed inoculation might cause drying of cotton-swab specimen or cause diffusing of oxygen within syringe-aspirated specimen. This might lead to missing of many bacteria particularly the anaerobes. Transport media could cause overgrowth of contaminant bacteria, resulting in false-positive cultures.

CONCLUSION

It is better to obtain wound specimen by syringe and inoculated on culture media immediately by bedside without using transport media.

REFERENCES

1. Waldvogel FA, Medoff G, Swartz MN. Osteomyelitis: A review of clinical features, therapeutic considerations and unusual aspects (three parts). N Engl J Med 1970;282:206, 260-6, 316-22.
2. Dich VQ, Nelson JD, Haltalin KC. Osteomyelitis in infants and children: A review of 163 cases. Am J Dis Child 1975;129:1273-8.
3. Perry CR, Pearson RL, Miller GA. Accuracy of cultures of material from swabbing of the superficial aspect of the wound and needle biopsy in the preoperative assessment of osteomyelitis. J Bone Joint Surg 1991;73-A:745-9.
4. Mauerhan DE, Nelson CL, Smith DL, et al. Prophylaxis against infection in total joint arthoplasty: one day of cefuroxime compared with three days of cefazolin. J Bone Joint Surg 1994;76-A:39-45.
5. Pichichero ME, Friesen HA. Polymicrobial osteomyelitis: report of three cases and review of the literature. Rev Infect Dis 1982;4:86-96.
6. Freeland AE, Senter BS. Septic arthritis and osteomyelitis. Hand Clin 1989;5:533-52.
7. Finegold SM, Baron EJ. "Baily and Scott's Diagnostic Microbiology". 7th edn. St Louis: Mosby Co, 1986.
8. Last JM. "Public Health and Human Ecology". USA: Appleton and Lange, 1987:76-9.
9. Jawetz E, Melnick JL, Adelberg EA. "Jawetz, Melnick and Adelberg's Medical Microbiology". 19th edn. USA: Appleton & Lange, 1991: 224-9, 289-93.
10. Mousa HAL. Evaluation of sinus-track cultures in chronic bone infection. J bone Joint Surg(Br) 1997;79-B:567-9.