A SURVEY OF POSTOPERATIVE WOUND INFECTIONS IN OBSTETRICS AND GYNAECOLOGY - THE KANDANG KERBAU HOSPITAL EXPERIENCE

J Y H Chia, K W Tan, L Tay

ABSTRACT

Postoperative wound infection is of great importance to both the surgeon and patient. This study covers 6,639 major operations in Kandang Kerbau Hospital, Singapore over a 12-month period. The overall wound infection rate was 2.26%. The highest wound infection rate occurred in hysterectomies and the lowest in laparoscopies. There was a good correlation between monthly caesarean wound infection rate and number of caesarean sections. Staphylococcus aureus was the most common organism isolated. The wound infection rate was also higher in crowded wards and among some surgeons. After distribution of the survey results, we noted a decrease in wound infection rate for some surgeons and a changing pattern in the use of antibiotics. A further study of other risk factors was encouraged.

Keywords: *wound infection, obstetrics and gynaecology*

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INTRODUCTION

All surgeons know that postoperative wound infection means morbidity, anxiety, longer hospitalisation and therefore more costly bills to patients; not to forget the embarrassment of the surgeons. However, it is still a common surgical complication despite other advances in modern medicine.

It is important to realise that wound infection may be prevented in many cases, provided there is constant awareness among members of the surgical team. Our search of the local medical literature revealed only one study on operative wounds in the last ten years[1].

This study by the Hospital Infection Committee at the Kandang Kerbau Hospital, Singapore was prompted by an increase in the monthly wound infection rate in the second half of 1990. Our main objective was to find out any preventable risk factors responsible for the increase in wound infection rate.

We noted that some of the findings are similar to the experience of others around the world[1-5]. More importantly, we identified a few features that may be unique to Singapore. The 12-month review formed the basis of this report which aimed to provide a general view of the topic.

MATERIALS AND METHODS

Kandang Kerbau Hospital is a tertiary care hospital specialised in obstetrics, gynaecology and neonatology with a total bed strength of 590. The supporting departments are radiology, pathology and bacteriology, all subspecialised in obstetrics, gynaecology and neonatology. The Hospital Infection Committee consists of representatives from all departments. We have two full-time infection surveillance nurses and one of them was involved in this study.

Our surveillance on wound infection is an on-going project. However, in this 12-month study we analysed the data collected from 1st July 1990 to 30th June 1991. There were a total of 36,367 admissions and 14,546 deliveries. All patients who had caesarean sections and abdominal gynaecological operations were included in the study. (Cases of vaginal surgeries were excluded because the vaginal mucosa is different from the abdominal skin as it is more prone to contamination preoperatively, intraoperatively and postoperatively).

The Committee's working definition for wound infection is the presence of purulent discharge from the wound with or without a positive bacteriological culture[2].

All cases of postoperative wound infection in the wards were detected by our infection surveillance nurse during her daily round. Cases of post-discharge wound infection were picked up on re-admission or at the out-patient clinics when procedures like wound dressing were done.

These cases were followed up by the infection surveillance nurse. Records of clinical and laboratory data were compiled and entered into a computer. Monthly analysis of various infection rates and risk factors were made. These were reviewed and monitored by the Hospital Infection Committee. Once our main objective was achieved, the findings were presentcd to hospital staff in a seminar.

As this study went on, all surgeons were informed of their individual monthly surgeon specific infection rate. At the same time antibiogrammes showing organisms involved in wound as well as other infections, and their sensitivity were distributed to all doctors from medical officers and above.

RESULTS

There were 6,639 major operations during the survey, of which 2,489 were caesarean sections and 4,150 were gynaecological operations. Of these, 150 cases had wound infection, therefore the overall wound infection rate was 2.26%. There were 57 wound infections after caesarean sections (2.29%). Operations with the lowest wound infection rate were laparoscopy and sterilisation. The highest wound infection rate occurred in the miscellaneous group which consisted mainly of radical and extended hysterectomies (Table I).

The types of surgical wounds included in this study were clean wounds and clean-contaminated wounds (Table II). The infection rates were 0.79% and 3.6% respectively (Table III).

Department of Maternal Foetal Medicine
Kandang Kerbau Hospital
1 Hampshire Road
Singapore 0821

J Y H Chia, M Med(O & G)
Senior Registrar

Department of Neonatology II
Kandang Kerbau Hospital

K W Tan, M Med(Paediatrics)
Senior Consultant and Head

Department of Pathology
Kandang Kerbau Hospital

L Tay, MBBS, D Bact(Manchester)
Consultant Bacteriologist

Correspondence to: Dr J Y H Chia

Table I - Wound infection rate for different types of operation

Type of Operation	No. of Operations	No. of Wound Infections	Infection Rate (%)
Caesarean Sections	2,489	57	2.29
Gynaecological Operations			
Hysterectomy	786	43	5.47
Laparotomy	539	10	1.85
Sterilisation	1,429	13	0.90
Laparoscopy	1,057	2	0.18
Miscellaneous	339	25	7.37
Total	6,639	150	2.26

Table II - Classification of wounds in relation to contamination[13]

Classification	Description
Clean Wound	Non-traumatic, no inflammation, no break in aseptic technique. Respiratory, alimentary, genito-urinary tracts not entered.
Clean-contaminated Wound	Gastrointestinal or respiratory tracts entered without significant spillage. Genito-urinary tract entered in the absence of infected urine. Biliary tract entered in the absence of infected bile. Minor break in aseptic technique.
Contaminated Wound	Major break in aseptic technique. Acute inflammation without pus. Gross spillage from gastrointestinal tract. Fresh traumatic wound. Entrance of genito-urinary or biliary tracts in presence of infected bile or urine.
Dirty Wound	Acute bacterial inflammation encountered, with pus. Transection of clean tissue for purpose of surgical access to a collection of pus. Perforated viscus encountered. Traumatic wounds more than 4 hours duration.

Table III - Wound infection rate for different types of wound

Type of Wound	No. of Operations	No. of Wound Infections	Infection Rate (%)
Clean	3,164	25	0.79
Clean-Contaminated	3,475	125	3.59
Total	6,639	150	2.26

The 150 wound infections were diagnosed from the third to eighteenth postoperative day and by the eighth day 117 (78%) of the cases were discovered. In 96 (64%) of the cases diagnosis was made between the fifth and eighth postoperative day with the peak on the eighth day (Fig 1).

The trend of wound infection

During the survey, we noticed a peak period in the number of deliveries from October 1990 to December 1990. The number of caesarean sections was also higher during these months. It was interesting that the wound infection rates after caesarean section mirror the same peaks as the number of caesarean sections and deliveries (Fig 2).

Fig 1 - Diagnosis of wound infection

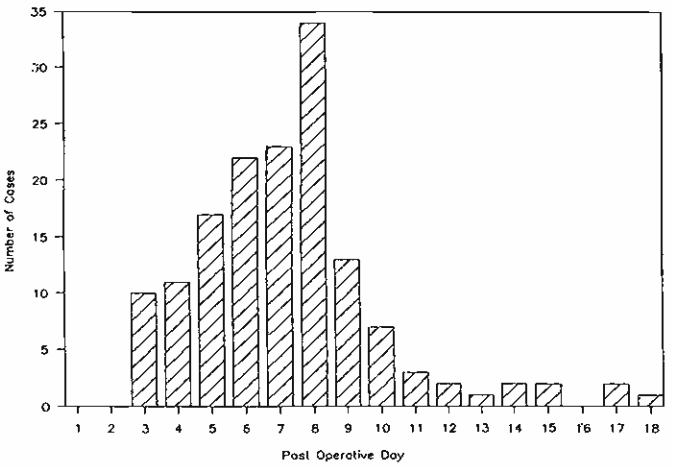
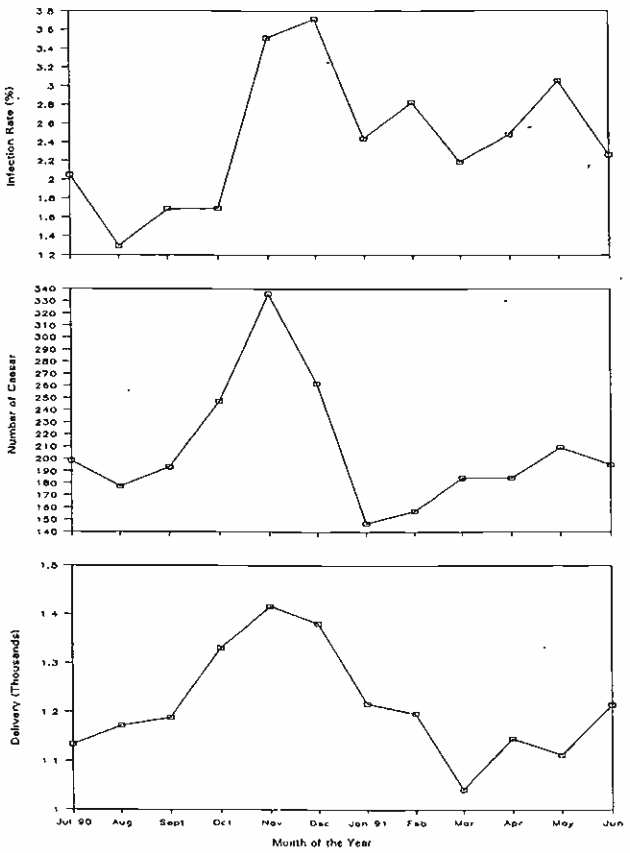


Fig 2 - Trend of caesarean wound infection in relation to number of caesarean sections and delivery

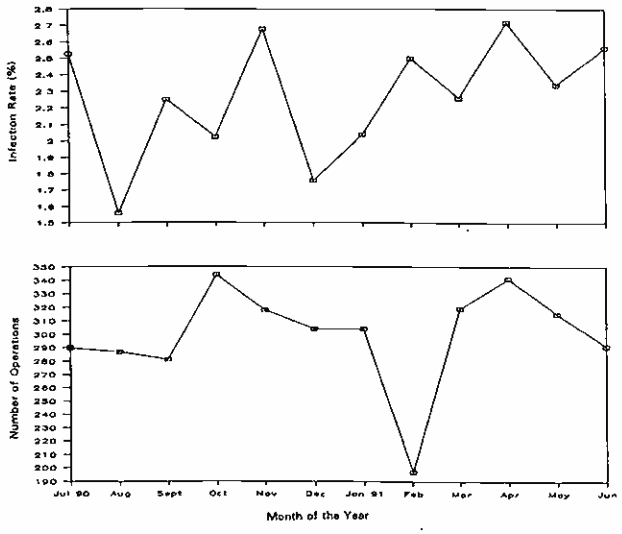


The infection rate for gynaecological operations was relatively constant. However the number of gynaecological operations showed yet another interesting trend. There were fewer operations in August and September, around the Chinese ghost month. There was a remarkable dip in February, around Lunar New Year. Both periods were followed by a rebound sudden surge in the number of operations (Fig 3).

Wards

In Kandang Kerbau Hospital the layout of the wards is in accordance to the class. Paying wards (A1, A2 and B1) consist of rooms which accommodate 1 to 4 persons. Class B2 and C wards with 30 and 60 persons respectively are open wards where beds are relatively crowded. In this study the wound infection rate was higher in the more crowded wards (ie B2 and C). During the period of this study two C class wards were renovated to paying wards. The wound infection rates for these wards dropped after the conversion.

Fig 3 - Trend of gynaecological wound infection in relation to number of gynaecological operations



Bacteriology

Wound swabs for culture and sensitivity were sent in 127 (84.7%) of the 150 cases of bacterial wound infection. Twenty-nine (22.8%) showed no bacterial growth. Ninety-eight (77.2%) had positive cultures, of which 7 grew two different organisms.

Among the aetiological agents isolated, *Staphylococcus aureus* was the most common organism, 61 out of 105 (58.1%). Of these 52 (49.5%) were MSSA (Methicillin sensitive *Staphylococcus aureus*) and 9 (8.6%) MRSA (Methicillin resistant *Staphylococcus aureus*). These were followed by *Streptococcus* species 11 (10.5%) and *Klebsiella* species 10 (9.5%) (Table IV).

Table IV - Bacteria isolated from wound infection

Organism	No. of Isolates	(%)
Gram Positive		
Staphylococcus aureus		
- MSSA	52	(49.5 %)
- MRSA	9	(8.6 %)
Streptococcus sp	11	(10.5 %)
Gram Negative		
Klebsiella sp	10	(9.5 %)
Enterobacter sp	6	(5.7 %)
Ps aeruginosa	5	(4.8 %)
E coli	4	(3.8 %)
Proteus sp	3	(2.9 %)
Acinetobacter sp	3	(2.9 %)
"Gram negative bacilli"	1	(0.9 %)
Others		
Candida sp	1	(0.9 %)
Total	105	(100.0 %)

Surgeons

The infection rate for individual surgeons ranged from 0% to 8.7% for the period of survey. For surgeons with a larger number of operations, it was found that not only was the number of wound infections higher but the rate was higher too. The rate was also higher among oncologists whose operations require longer operating time.

Effects of Study

After presentation of the findings and distribution of surgeon specific infection rates, we saw a small drop in wound infection rate for some surgeons. We noticed that the feedbacks which can be positive or negative help us to improve our surveillance. Knowing that *Staphylococcus aureus* was the most common organism, many doctors were starting to use cloxacillin to treat wound infection rather than the time honoured ampicillin and metronidazole combination. With the increase in number of prescriptions for cloxacillin, we noticed a reduction in usage of other antibiotics for wound infection at the end of the study in March to June 1991 compared to the same period in 1990, just before the study (Table V).

Table V - Antibiotics prescribed for wound infection before and at the end of study

Antibiotics	Before Study (Mar-Jun 1990)	End of Study (Mar-Jun 1991)
Ampicillin	6 (11.3%)	3 (6.3%)
Ampicillin & Metronidazole	29 (54.7%)	18 (37.5%)
Ampicillin & Cloxacillin	4 (7.5%)	6 (12.5%)
Ampicillin & Gentamicin	1 (1.9%)	0 (0.0%)
Unasyn(R)	6 (11.3%)	3 (6.3%)
Augmentin(R)	3 (5.7%)	2 (4.1%)
Cloxacillin	3 (5.7%)	16 (33.3%)
Ceftriaxone	1 (1.9%)	0 (0.0%)
Total	53 (100.0%)	48 (100.0%)

DISCUSSION

In this study, the overall wound infection rate of 2.26% was relatively low compared to most studies[1-4]. The infection rate of 2.29% after caesarean section was also low compared to reports by Parrott (11.3%), and Moir (6%) which was a multicentre study[3,5].

The wound infection rate for clean-contaminated wounds (3.6%) was more than four times that of clean wounds (0.79%). Both were within the recommended limits of 5-10% and <1% respectively[4,6].

We would have expected a higher infection rate in caesarean sections (2.29%) compared to hysterectomies (5.47%), as the majority of the former were emergency caesarean sections which involved higher risk of contamination from prolonged labour, foetal monitoring and repeated vaginal examinations. This survey showed the contrary. Therefore, other factors like the longer operating time and tissue damage to the wounds by the self-retaining retractors in hysterectomies were probably contributory. Furthermore, most patients undergoing hysterectomies were usually above forty years of age and may have medical complications like diabetes mellitus.

Sterilisations and most laparoscopies were short operations with no contamination from the vagina. It is not surprising that the wound infection rates were lowest for these groups.

The miscellaneous group with the highest infection rate comprised mainly of radical hysterectomies. These were long and extensive operations performed for carcinoma of the cervix or endometrium which occur in older patients who are more at risk.

We finally got the answer to the main objective of our survey, after finding a corresponding "peak" in caesarean wound infection rate with number of deliveries and caesarean sections from October to December. Demographic data showed similar "baby booms" in Singapore in all the previous ten

years[6]! There were several risk factors which may contribute to the increased infection rate. The patient to staff ratio would increase. The movement of both patients and staff in and out of theatres would be increased. There would be shorter cleaning time between operations. We will be in a better position to take necessary precautions during this "peak period" in the years to come.

This study reminded us of a basic fact that there is a close relation between medicine and culture. Firstly, the cultural basis of "Singaporean baby boom" between October and December. Weddings are more common during the Christmas and New Year holiday season. By tradition, Chinese like to get married before the Lunar New Year which is usually in February. Therefore, we would expect a surge in deliveries about nine months later. Modern Singaporeans also plan the arrival of their babies[7]. One of the trends is to deliver before the 31st of December, so that the child can make it to the school in time. Apart from family planning, requests for social induction before this dateline is not uncommon. This coincides with the end of the peak. As for the small number of gynaecological operations around the Chinese ghost month and Lunar New Year, few Chinese would want an elective operation during this period. Therefore, a surge was expected after each respective season.

The upgrading of Kandang Kerbau Hospital provided an excellent model to compare the crowded C and B2 wards, with paying wards. In two instances, the infection rate dropped after renovation from C class to paying wards. The reason for higher infection rate in crowded wards was probably that patients are exposed to more of other patients, visitors and hospital staff. Unfortunately, we were not able to include the social status of patients in this study which was probably contributory as well[8].

As in most studies, *Staphylococcus aureus* was the most common bacteria isolated. *Staphylococcus aureus* contributed to 61 or 58.1% of the organism isolated. This is not surprising as it is a natural flora on the skin. On the other hand, only about 30% of the bacteria isolated were gram negative which was contrary to the general belief that wound contamination in obstetric and gynaecological operations is from the genital tract.

Surgeon specific wound infection rate by itself may be misleading and some times dangerous[9]. Although operating technique is important[10], we have to consider factors like the number of surgeons, assistants and scrub nurses in major operations. Neither can we blame the oncologists, as extensive operations, long operating time and patient factors are probably more important than the surgeon factor.

There are other factors which we were unable to analyse because of insufficient data. One of these is the use of prophylactic antibiotic and its cost-effectiveness[11,12]. This has since become a joint project between the Hospital Infection Committee, and the Pharmaceutical and Therapeutical Committee at the moment.

An on-going infection surveillance is to be encouraged. We can minimise the infection rate by identifying and acting on the risk factors involved. For maximum benefit, our recommendation is to distribute the findings to all members of the theatre and ward teams. A constant awareness will make everybody take precautions and thus lower infection rate. In addition, surgeons are well informed of the current common organisms and their sensitivity.

We are still in the infancy of this subspecialty. With the help of computer and mathematical analysis, bigger multicentre surveys are possible and more detailed study of various risk factors can be explored in the future.

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