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## **Risk Factors for Wound Infection After Cholecystectomy**

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### **Abstract**

Biliary surgery in general, with cholecystectomy in particular is a common major elective abdominal operation world wide. Wound sepsis after biliary surgery is an extraburden to patients, surgeon and nation. This prospective study has been completed on 160 patients underwent biliary surgery at kasr El-Aini Hospital, 105 of them were females and 55 were males. Their ages ranged from 30 to 70 years with an average of 44 years. The overall incidence of postoperative wound infection was 15%. Three major risk factors were detected for wound infection: aged patients above 60, other operative procedures added to cholecystectomy and contaminated bile. Bactibillia was an important endogenous source of postoperative wound infection which was detected in all cases of acute cholecystitis and in 87.5% of cases with calcular obstructive jaundice and in 60% of patients with stones in the common bile duct and have no jaundice. In twenty one out of 24 of infected cases, the organisms isolated from wounds were the same as from the corresponding bile samples. Prophylactic antibiotic is recommended in patients with risk factors detected in this study, while routine antibiotic prophylaxis in simple cholecystectomy is probably unjustified.

### **Introduction**

**EXTENSIVE** studies characterise the risk factor for postoperative wound infection after all bladder surgery. These studies reported a string association between the presence of bacteria in bile at surgery and occurrence of subsequent infection [1]. Other risk factors include aged patients (over 60 years), concomitant operation as

appendicectomy [2] emergency operations, previous biliary operation, stones in the bile duct and in presence of obstructive jaundice [3].

The present study was performed to determine the rate of wound infection after cholecystectomy and to any extent these risk factors can affect the incidence of postoperative wound infection.

### Subjects and Methods

The studied cases were 160 patients (105 females and 55 males) who underwent biliary surgery at Kasr El Aini Hospital.

- 1- All cases were subjected to full clinical assessment with recording of associated diseases.
- 2- During surgery, full operative notes were recorded as regards the type of surgical procedure done, length of operation, type of suture material and type of antibiotics given and its duration.
- 3- Intra-operative bile sample was taken by needle aspiration of gall bladder, centrifuged and the deposit was cultured.
- 4- Postoperative observation of wounds for signs of infection.
- 5- Bacteriological study:

Each specimen (bile or swab) was cultured aerobically and anaerobically on blood agar and MacConkey's agar media. The plates were incubated at 37°C for 24 hours aerobic cultures and 72 hours for anaerobic cultures.

The isolated organisms were identified by standard microbiological techniques [4].

Antibiogram was done for the isolated organisms by disc diffusion method [5].

The antibiotics used were: Ampicillin (10 µg/disc), Tetracyclin (30 µg), Amikacin (30 µg), Gentamycin (10 µg), Rifampicin (30 µg), Cepharidin (30 µg), Erythromycin (15 µg), Fluxacillin (30 µg), Chloramphenicol (30 µg) and Kanamycin (30 µg).

### Results

The studied cases were 160 patients, 105 females and 55 males with age range from 30-70 years. The overall rate of

wound infection was 24 out of 160 (15%).

The rate of postoperative wound infection in cholecystectomy operations associated with other procedures was significantly higher than that in cholecystectomy alone (29.8% and 6.8% respectively).

Cholecystectomy of acute cases complicated with postoperative wound infection were 4 out of 8 (50%), Table (1).

Table (2) shows the rate of wound infection in relation to bile culture. Positive bile culture (Bactibilia) was 60 out of 160 (37.5%). Cases complicated with wound infection were 21 out of them (35%).

Negative bile cultures were 100 (62.5%) and only 3 cases (3%) were complicated with wound infection.

E.coli was the predominant organism isolated from bile cultures (65%) and from infected wounds (58%). B.fragilis (15 strains) was the only anaerobic organism isolated and found to be mixed with E.coli (Table 3).

The risk of bactibilia as an endogenous source of wound infection was observed in 21 out of 24 cases. The organisms isolated from infected wound and those isolated from the corresponding bile samples were the same (Table 4).

As regards the antibiogram, amikacin was found to be the most effective drug followed by kanamycin. Most E.coli isolates were sensitive to most antibiotics tested. Proteus vulgaris and Ps. aeruginosa isolates were resistant to a wide range of antibiotics. (Table 5).

Age above 60 was confirmed as an important risk factor for both bactibilia and wound infection. Table (6) shows the incidence of bactibilia and wound infection in

relation to age. Bactibilia was found in 53.3% of patients above 60 years and 25% of them were complicated by postoperative wound sepsis.

Table (7) shows the possible risk factors for wound infection. Age above 60

years (25%), other procedures associated with cholecystectomy (29.8%) and contaminated bile (35%) were the three major risk factors observed in this study, while the duration of preoperative stay in hospital and duration of the operation were minor risk factors.

Table (1): Wound Infection in Relation to the Type of Surgical Procedure.

| Type of surgery                              | No. of patients | Wound infection |             |
|--|-----------------|-----------------|-------------|
|  |                 | No.             | %           |
| <i>Cholecystectomy alone:</i>                |                 |                 |             |
| Acute cases                                  | 8               | 4               | 50          |
| Chronic cases                                | 95              | 3               | 3.2         |
| <b>Total</b>                                 | <b>103</b>      | <b>7</b>        | <b>6.8</b>  |
| <i>Cholecystectomy and other procedures:</i> |                 |                 |             |
| Choledochostomy                              | 52              | 15              | 28.8        |
| Appendectomy                                 | 3               | 2               | 66.6        |
| Liver biopsy                                 | 1               | 0               | 0           |
| Hiatus hernia                                | 1               | 0               | 0           |
| <b>Total</b>                                 | <b>57</b>       | <b>17</b>       | <b>29.8</b> |
| <b>Grand total</b>                           | <b>160</b>      | <b>24</b>       | <b>15</b>   |

Table (2): Bactibilia and Wound Infection.

| Biliary pathology                     | No.        | Bile culture (Positive) | Wound infection | Bile culture (Negative) | Wound infection |
|---------------------------------------|------------|-------------------------|-----------------|-------------------------|-----------------|
| Uncomplicated gall stones             | 95         | 9                       | 2               | 86                      | 1               |
| Acute cholecystitis                   | 8          | 8                       | 4               | 0                       | 0               |
| <i>Common bile duct stones:</i>       |            |                         |                 |                         |                 |
| - No jaundice                         | 20         | 12                      | 3               | 8                       | 0               |
| - With jaundice                       | 32         | 28                      | 10              | 4                       | 2               |
| Cholecystectomy with other procedures | 5          | 3                       | 2               | 2                       | 0               |
| <b>Total</b>                          | <b>160</b> | <b>60</b>               | <b>21</b>       | <b>100</b>              | <b>3</b>        |



Table (6): Incidence of Bactibilia and Wound Infection in Relation to Age.

| Age in years | No. of cases | Bactibilia |      | Wound infection |    |
|--------------|--------------|------------|------|-----------------|----|
|              |              | No.        | %    | No.             | %  |
| Below 60     | 100          | 28         | 28   | 9               | 9  |
| Above 60     | 60           | 32         | 53.3 | 15              | 25 |
| Total        | 160          | 60         | 37.5 | 24              | 15 |

Table (7): Possible Risk Factors for Wound Infection Following Biliary Operations.

| Risk factors                         | No. of patients | Infected wounds |      | Test proportion |
|--------------------------------------|-----------------|-----------------|------|-----------------|
|                                      |                 | No.             | %    | Value           |
| Age:                                 |                 |                 |      |                 |
| Below 60                             | 100             | 9               | 9    | 2.54*           |
| Above 60                             | 60              | 15              | 25   |                 |
| Preoperative hospital stay:          |                 |                 |      |                 |
| < 6 days                             | 120             | 19              | 15.8 | 0.53**          |
| > 6 days                             | 40              | 5               | 12.5 |                 |
| Duration of operation:               |                 |                 |      |                 |
| < 120 min                            | 81              | 11              | 13.5 | 0.5**           |
| > 120 min                            | 79              | 13              | 16.4 |                 |
| Bactibilia                           | 60              | 21              | 35   | 5.0*            |
| No bactibilia                        | 100             | 3               | 3    |                 |
| Type of operation:                   |                 |                 |      |                 |
| Cholecystectomy                      | 103             | 7               | 6.8  |                 |
| Cholecystectomy and other procedures | 57              | 17              | 29.8 | 3.5*            |

\*  $p < 0.05$ \*\*  $p > 0.05$ 

### Discussion

In spite of the modern standards of preoperative preparation, antibiotic prophylaxis and refinement in anesthetic and operative techniques, postoperative wound infection remains a serious problem.

The incidence of postoperative wound

infection in a retrospective analysis was no more than 5% [6,7]. Another series of studies reported incidences between 15% and 30% [8,9,10]. These wide variations are the result of many factors including technical ones such as operative techniques and wound haematoma. However, other factors such as the type of biliary pathology con-

tributes to the risk of infection.

The results of this study demonstrated that the overall incidence of wound infection was 15%. Wound infection was 6.8% in patients subjected to cholecystectomy alone compared to 29.8% in cholecystectomy associated with other procedures. Lewis et al. [9] and Cainzos et al. [10] reported similar results.

Targarona [11] reported that postoperative wound infection in biliary surgery is due to endogenous contamination produced by opening the biliary tract in patients with bactibilia. The risk of bactibilia, as an important endogenous source of wound infection had been observed in 21 out of 24 (86.5%) complicated cases with wound infection.

Cainzos et al. [10] reported 16% incidence of bactibilia in non complicated gall stones and the rate of wound infection complicating these cases was 2.8%. In this study the incidence of bactibilia in this group was 9 out of 95 (9.5%) and the rate of wound infection was 3 out of 95 (3.2%). Therefore, it could be considered as clean surgical procedure.

The incidence of bactibilia is highly increased in cases with calculi in the choledochus, even though there may be no obstruction. The reported incidences varied from 37% to 62% [12,13,14].

In this study 12 out of 20 (60%), of non complicated common bile duct stones had positive bile culture and the rate of wound infection in such cases was 25%.

Higher incidence of bactibilia was reported in cases with obstruction in the biliary flow and had jaundice. Watts et al. [14] reported 81% incidence of bactibilia and the complicated cases with wound in-

fection was 36%. In this study 28 out of 32 (87.5%), with calcular obstructive jaundice showed bactibilia and the infection rate was 36%. Therefore it is necessary to consider this type of operation as potentially contaminated.

Acute cholecystitis is well established as one of the high risk factors for bactibilia and wound sepsis [12,15]. In this study bactibilia was found in all acute cholecystitis cases and 50% of them were complicated with wound sepsis.

Most studies reported the predominance of alimentary organisms such as *E.coli*, *Streptococcus faecalis* and *Klebsiella* species with lower incidence of other streptococci, staphylococci and anaerobic organisms [15,16].

The most common organism isolated in this study was *E.coli* from 65% of positive bile cultures.

Rebert et al. [17] reported that anaerobic organisms account for 41% of positive bile cultures and in most instances they were associated with aerobic organisms. In this study *B.fragilis* was isolated from 20% of positive bile cultures and in all cases they were mixed with *E.coli*.

The age of the patient is also another important factor to be considered in the development of postoperative wound infection. Keughly [18] reported that postoperative wound infection rate in patients less than 70 years undergoing cholecystectomy was 7% whereas in patients over 70 years it was 11%. In this study 25% of patients above 60 years were complicated by postoperative wound infection.

The antibiogram of the isolated organisms in this study showed that aminoglycosides (kanamycin, amikacin and gentamy-

cin) were effective. These antibiotics are important for prophylactic and therapeutic purposes in biliary surgery although they are poorly excreted in bile.

Keighley [19] reported that serum antibiotic concentration was more important than biliary than biliary antibiotic level in reducing postoperative wound sepsis. The author advised the use of aminoglycosides in serious conditions and to use cephalosporins as prophylactic antibiotic in biliary surgery.

### References

- 1- COX J.L., HEKFRICH R.L. and PARN M.I.: The relation between biliary tract infections and postoperative complications. *Surg. Gynecol. Obstet.*, 146: 233-236, 1978.
- 2- PALLOCK A.V. and EVANS M.: Wound sepsis after cholecystectomy: Effect of incidental appendectomy. *Br. Med. J.*, 1: 20-22, 1977.
- 3- AMBROSE N.S., MORRIS O.L., BURDON D.W., WILLIAMS J.A. and KEIGHLEY M.R.B.: Comparison of selective and non-selective single dose antibiotic cover in biliary surgery. *World J. Surg.*, 11: 101-104, 1987.
- 4- ISENBERG H.D., WASHINGTON G.A., DALOWS A. and SOMENWERTHM A.D.: Collection, handling and processing of specimens. Cited from *Manual of Clinical Microbiology*, Lenette, E.H. et al., 3rd edition. American Society for Microbiology. Washington D.C., p. 52, 1980.
- 5- CRUICHSANK R., DUGUID J.P., MARISMION B.P. and SWAIN R.H.: *Medical microbiology*. 3rd edition, p. 181, 1975.
- 6- RAINE P.A.M. and CUNN A.A.: Acute cholecystitis. *Br. J. Surg.*, 62: 697, 1975.
- 7- RODD G.J. and REEMTSMA K.: Cholecystectomy with drainage. *Am. J. Surg.*, 135: 622, 1978.
- 8- KAUFMAN Z., ENGELBERG M.E., LIASHIV A. and REISS R.: Systemic prophylactic antibiotic in elective biliary surgery. *Arch. Surg.*, 119: 1002, 1984.
- 9- LEWIS R.T., ALLAN C.M. and GODALL R.G.: A single preoperative dose of cefazolin prevents postoperative sepsis in high risk biliary surgery. *Can J. Surg.*, 27: 44, 1984.
- 10- CAINZOS M., PAATEL J. and PUENTE J.L.: Prospective randomized study of prophylaxis with cefamandole in high risk patients undergoing operations upon the biliary tract. *Surg. Gyn. Obs.*, 160: 27-32, 1985.
- 11- TARGARONA E.M.: Single dose antibiotic prophylaxis in patients at high risk for infection in biliary surgery: A prospective and randomised study comparing cefobid with mezlocillin. *Surgery*, 107: 327 (334), 1990.
- 12- CHELTIN S.H. and ELLIOT D.E.: Biliary bacteraemia. *Arch. Surg.*, 102: 303, 1971.
- 13- KEIGHLEY M.R.B., DRYSDALE R.B., QUORAISHI A.H., BURDON D.W. and WILLIAMS J.A.: Antibiotic treatment of biliary sepsis. *Surg. Clinic of North America*, 55: 1379, 1975.
- 14- WATTS J., ROBERT A.B. and FINLAY-JONES J.J.: Infection in biliary tract surgery: Finders medical center experience in infection in surgery. basic and clinical aspects. Cited from Watts, J., Donald P.E. and Bien, O. (ed.) p. 187-193. New York, Churchill Livingstone.
- 15- PITT H.A., POSTIER R.G. & GAMERON J.L.: Biliary bacteria. Significance and alterations after antibiotic therapy. *Arch. Surg.*, 117: 445, 1982.
- 16- TRUDSON H., ELMOROS I. and HOLMS

- S.: The incidence of bacteria in gall bladder bile at acute and elective cholecystectomy. *Acta. Chir. Scand.*, 194: 308, 1982.
- 17- ROBERT A.B., FINLAY-JONES J.J. and WALTERS J.M.: Anaerobic organisms and acute cholecystitis. *Surg. Gastroenterol.*, 1: 183, 1982.
- 18- KEIGHLEY M.R.B.: Microorganisms in the bile. A preventable cause of sepsis after biliary surgery. *Ann. R. Coll. Surg. Engl.*, 59: 328-334, 1977.
- 19- KEIGHLEY M.R.B.: Infection and the biliary tree in the biliary tract. Cited from Blumgart, L.M. p. 219-225. Edinburgh, Churchill Livingstone, 1982.