MINISTRY OF EDUCATION AND TRAINING MINISTRY OF DEFENCE VIETNAM MILITARY MEDICAL UNIVERSITY

---------------------------------

PHAM VAN TAN

STUDY ON THE SITE WOUND INFECTION OF THE GASTROINTESTINAL SURGERY AT SURGEON DEPARTMENT IN BACH MAI HOSPITAL

Major: Surgical gastroenterology

No.: 62 72 01 25

SUMMARY OF PHD THESIS IN MEDICINE

HA NOI – 2016

STUDY WAS COMPLETED AT VIETNAM MILITARY MEDICAL UNIVERSITY

*The scientific supervisor:*

1. Prof.Dr. NGUYEN NGOC BICH

2. Prof.Dr. VU HUY NUNG

Reviewer 1: .

.

Reviewer 2:

.

Reviewer 3: . .

.

The thesis will be defended at the state thesis Council meeting at Military Medical University

at......hour.....,day......month.......year 2016

This thesis can be found at :

1. National Library

2. Library of Military Medical University

PUBLICATION

1. Pham Van Tan, Nguyen Ngoc Bich, Vu Huy Nung (2015), “Relation between gastrointestinal surgery wound infections with surgery factors at the department of surgery”, *Journal of Medicine, September, No.1/2015*, Hanoi, page 1-4.

2. Pham Van Tan, Nguyen Ngoc Bich, Vu Huy Nung (2015), “Antibiotics resistance of some bacterial which caused gastrointestinal surgery wound infection at the department of surgery, Bach Mai hospital”, *Journal of Medicine, September, No.1/2015*, Hanoi, page 41-46.

INTRODUCTION

Surgery wound infection (SWI) is not only an issue for developing countries but also a priority concern in developed countries. SWI is caused by bacteria, virus, fungi and parasite; in which bacteria is a common pathogen. The infiltration, development and pathogenicity of the SWI causes depend on four risk factors groups which are evironmental factor, surgical factor, patient factor and bacterial factor.

In the surgical operation, gastrointestinal surgery has a higher risk of SWI because of exposure to bacteria during disgestive interferion. Bach Mai hospital, one of the biggest hospitals in Vietnam, has the rate of SWI about 4.2% - data from Nguyen Quoc Anh’s research in 2008.

In fact, the SWI status in the gastrointestinal surgery has not received enough attention. The question is what is the SWI status and causes of the gastrointstinal surgery in Bach Mai hospital? Which risk factor influences SWI? What is the gastrointestinal SWI treatment? All these issues are the reasons of conducting this research with following objectives:

1. Identifying the cause and several related factors of the gastrointestinal SWI at the Department of Surgery, Bach Mai hospital, 2011-2013.
2. Evaluating the treatment result of the gastrointestinal SWI at the Department of Surgery, Bach Mai hospital, 2011-2013.

THE CONTRIBUTION OF THE THESIS

1. This thesis described the percentage and some characteristics of bacteria in the gastrointestinal SWI in Bach Mai hospital, which is one of the biggest hospitals in Viet Nam. The percentage of SWI was 3.6%; the isolation rate was 64.4%: Most of bacteria were Gram negative including mainly *E.coli*. The antibiogram showed the high percentage of antibiotic resistance such as *E.coli* resisted with Ampicillin, Cephalisporin and Quinolone; *Pseudomonas aeruginosa* resisted to almost all antibiotics including Carbapenem group; *Klebsiella pneumoniae* resisted to most antibiotics excepted for Carbapenem group.
2. The thesis identified some main risk factors of the gastrointestinal SWI: a history of the gastrointestinal surgery; more than 2 organs surgery; infectious surgery; unhygienic surgery; the surgical time more than 120 minutes; the small intestine surgery; appendiceal surgery and appendiceal complication surgery; liver, bile and pancreatic surgery.

The thesis showed the treatment experience and result of the gastrointestinal SWI: Antibiotics, which were used extensively for gastrointestinal surgery of the patient in this research, were Cephalosporin and Metronidazole with the most combination therapy of two antibiotics. The percetage of patient who received this effective antibiotics treatment and recovering from the SWI was 100%.

THESIS STRUCTURE

The thesis has 125 pages, of which: 2 pages for the introduction; 39 pages for chapter 1: Overview; 12 pages for chapter 2: Objective and methodology; 32 pages for chapter 3: The result; 37 pages for chapter 4: The discussion; 02 pages for conclusion and one page for recomendation. The result of this thesis is shown in 44 tables and 05 charts. The thesis used 106 references that included 39 Vietnamese and 67 English references.

Chapter 1

OVERVIEW

1.3. Several microorganisms caused the SWI and the drug resistant status

1.3.1. Several microorganisms caused the SWI

There are various types of microorganisms causing SWI, which include bacteria, virus, fungi and parasite. Some bacteria mainly caused SWI such as *Enterobacteriaceae (Escherichia coli, Enterobacter cloacae,...* - Gram-negative bacilli in intestinal floral*); Pseudomonas aeruginosa; Klebsiella (Klebsiella pneumoniae, Klebsiella oytoca...)*; *Staphylococcus aureus* ; other bacteria and fungi.

1.3.2. The status of the drug resistance

*1.3.2.2. The antibiotic resistant situation*

The antibiotic resistance has become a global issue. The invention of new antibiotics has not reached the mutation of the microorganisms which has led to the antibiotic resistance and the risk of no antibiotics for the infection in the future. In Vietnam, because of the advantageous climatic condition for the microoganism growth and the ineffective infection control method as well as using antibiotics, the anibiotic resistance has become more aggravated. As a result, actions for this issue has recently been urged.

1.4. The related factor of the SWI

There are 4 groups of the SWI-related factor including: patients, environment, operation and pathogens. These factors combine and interact together to increase the risk of SWI

*1.4.1. Patient factor*

Patient characteristics have an important role in the SWI in the operation. Those factors include age; obesity/malnutrition; infectious condition; multiple injuries; heavy smoker; long hospitalization period before operation; diabetes, cancer; immudeficiency and patient condition before operation (severe illness).

1.4.2. Operation factor

The operation factors related to SWI such as a long duration of the operation; exotic material, foreign objects/drainage at the operation point; surgical techniques; surgical types; surgical forms; surgical numbers; blood loss during surgery; and dead space

*1.4.3. Microorganism factor*

The pathogeneticity of microorganisms is based on the toxicity, the amount and the adhensice capacity to the host. the selection and genetic exchange promotes the multi antibiotic resistance of the bacterial strains to survive, develop and become circulating strains in hospital.

*1.4.4. Environmental factor*

1.5. Prevention and treatment of the SWI

1.5.2. SWI treatment

*1.5.2.1. Using antibiotic combination based on antibiograms*

When appearing the sign of the systemic infection, the causes have been found by isolating the arobic and anaerobic bacteria from the pus, urine, secrections and blood. The high-dose antibiotics are descripted based on temporary result of the Gram stain while waiting for the conclusion from bacterial culture and antibiograms. According to antibiograms result, antibiotics are combined in the treatment.

*1.5.2.2*. Improving physical conditions

*1.5.2.3. Using anti-inflammatory drugs*

*1.5.2.4. Cutting intermittent sutures, wound cleaning and dressing/bandage changing*

*1.5.2.5. Using polyesteramide film technology*

Chapter 2

OBJECTIVE AND METHODOLOGY

2.1. Objective

The gastrointestinal surgical patients from the Department of Surgery in Bach Mai hospital from 2011-2013.

*- Selection criteria*: patients who meet these requirements: gastrointestianl surgery at the Department of Surgery in Bach Mai hospital at the study period; open surgery or open surgery with laparoscopic surgery support; having satisfied profile and agreeing to participate in the research.

*- Elimination criteria:* patients already have the gastrointestinal surgery before moving to Bach Mai hospital for continuing treatment/surgery; no treatment in the postoperation at the Surgeo Department; the operation of Anal incontinence, hemorrhoid, inguinal hernia.

2.2. Location and time study

01/01/2011- 31/12/2013 at the Department of Surgery, Bach Mai hospital.

2.3. Methodology

2.3.1. Research design

Descriptive cross-sectional studies, prospective analysis.

2.3.2. Sample and sampling method

Applying the convenience sampling method: Selecting all gastrointestinal surgical patients who have met the selection criteria of the time study from 01/01/2011 - 31/12/2013.

2.4. Data collection

Appropiate patients have recieved the clinical and subclinical examination, the determination of the SWI causes by microbiological sampling tests. The information and data have been collected and recorded into the medical study profile.

Patients with the SWI have continued the SWI treatment; tested antibiograms and recored the data into the medical study profile.

2.5. Study index

2.5.3. The index of the SWI

- The percentage of the SWI.

- Clascification of the SWI: (i) the incisional SSI (Superficial incisional, deep incision , organs/space); (ii) the study period; (iii) the surgical classification (clean, clean-contaminated, contaminated and dirty wounds); (iii) The organ surgery.

- The causes of SWI: (i) number of causes and (ii) the type of the causes

- The antibiotic resistant characteristic of the microorganisms causing SWI.

2.5.4. The index of the risk factors causing SWI

- The index of the patient factor: (i) age, (ii) gender, (iii) BMI, (iv) status of coexisting diseases, (v) the preoperative hospital stay, and (vi) the preoperative condition.

- The index of the surgical factor: (i) Surgical history, (ii) Surgical duration, (iii) Surgical form, (iv) Type of the surgery and (v) Organ surgery.

2.5.5. The index of the SWI treatment

- The feature of using antibiotics for SWI treatment: (i) Type of antibiotics, (ii) Number of antibiotics and (iii) Using antibiotics appropriate with the antibiograms; The SWI treatment: (i) Body, (ii) Site infection; Hospitalised duration: the period of staying at the Department of Surgery in Bach Mai hospital; The result of SWI treatment.

2.6. Criteria, technical evaluation of the study index

2.6.1. Criteria for defining the SWI

The diagnosis of the SWI has been conducted according to the Vietnamese MOH guideline and CDC. The SWI includes superficial incisional, deep incisional , organs/space infection.

2.8. Eliminating the error and analysing data

2.8.2. Collecting and analysing data

After collecting, the data was coded and inputed by Excel and then analyzed in SPSS 16.0 software.

## 2.9. Research ethics

The research ensured applying the measure without affecting to the treatment qualification of the hospital and also the health and economic benefits of the patient. The thesis proved by the ethics council of Military Medical Academy and Bach Mai hospital. All volunteered participants were explained about the purpose and content of the study. The study has adhered the international cooperation procedure and the pathogen specimen transportation procedure of the MOH.

Chapter 3

RESULT

During 3 years (2011-2013), there were 2861 appropriate patients in the study. The sample size were 2861 patients.

3.2. The cause and the factor related to the gastrointestinal SWI

3.2.1. The percentage of the gastrointestinal SWI

Figure 3.2: The percentage of the gastrointestinal SWI

Most patients were without SWI (96.4%); the SWI ratio was 3.6%.

- The distribution of the gastrointestinal SWI by the level: the superficial incisional SWI has the majority of the total infection (60,6%).

- The ratio of the gastrointestinal SWI by the surgical type: The ratio of the SWI increased gradually to the dirty level of the surgical type: The dirty surgery was 15%; the contaminated surgery was 6.4% and the clean - contaminated surgery was 1.4%.

- The ratio of the gastrointestinal SWI by organ surgery: The appendiceal surgery has a highest percentage of the SWI about 10,7%. The SWI ratio in the small intestine surgery was 4.2% and this ratio in the liver, bile and pancreatic surgery were 4.4% respectively.

3.2.2. The cause of the gastrointestinal SWI

Table 3.11: The isolation ratio of the SWI causes

|  |  |  |  |
| --- | --- | --- | --- |
| Sample | Number of the SWI sample | Number of the SWI sample isolated causes | Rate  (%) |
| Pus, wound exudate | 104 | 67 | 64,4% |

There was 64.4% of the SWI positive in 104 selectec SWI samples to culture for finding the pathogen.

- The ratio of the pathogenic number caused gastrointestinal SWI

There were 92.5% samples with single pathogen and 7.5% samples with more than 02 pathogens.

- The ratio of the pathogenic groups caused gastrointestinal SWI

The Gram negative bacteria took the highest proportion of the causing pathogen which accounted for 83.3%; the Gram positve has 15.3% and the fungi pathogen was around 1.4%.

- The ratio of the pathogenic isolation caused gastrointestinal SWI

Bacteria caused SWI were *Escherichia coli* with highest proportion about 61,1%; and following by *Pseudomonas aeruginosa* with 6,9% and *Klebsiella pneumonia* at 5,6%. The pathogens caused SWI including *Enterobacter cloacae; Enterococcus spp.* and *Streptococcus* *group B* have the same proportion approximately 4,2%. Other bacteria were 1.4%.

3.2.3. The antibiotic characteristics of the bacteria caused gastrointestinal SWI

Table 3.14: The antibiotic resistance of Escherichia coli (n = 44)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Antibiotics | Samples in antibiograms | Resistant  (%) | Intermediate  (%) | Susceptible  (%) |
| Ampicillin | 44 | 88,6 | 4,6 | 6,8 |
| Piperacillin | 5 | 80,0 | 20,0 | 0,0 |
| Ertapenem | 35 | 2,9 | 2,9 | 94,2 |
| Imipenem | 43 | 0,0 | 2,3 | 97,7 |
| Meropenem | 44 | 0,0 | 0,0 | 100,0 |
| Cefuroxime | 29 | 44,8 | 3,5 | 51,7 |
| Ceftazidime | 44 | 36,4 | 9,1 | 54,5 |
| Ceftriaxone | 38 | 50,0 | 0,0 | 50,0 |
| Cefotaxime | 10 | 60,0 | 0,0 | 40,0 |
| Cefepime | 43 | 23,3 | 25,6 | 51,1 |
| Amoxicillin + A.clavulanic | 9 | 44,4 | 22,2 | 33,3 |
| Ampi + Sulbactam | 5 | 60,0 | 0,0 | 40,0 |
| Piperacillin + Tazobactam | 43 | 4,7 | 16,3 | 79,1 |
| Cefoperazol + Sulbactam | 39 | 5,1 | 10,3 | 84,6 |
| Gentamycin | 44 | 27,3 | 0,0 | 72,7 |
| Tobramycin | 37 | 24,3 | 0,0 | 75,7 |
| Amikacine | 44 | 6,8 | 0,0 | 93,2 |
| Ciprofloxacine | 44 | 36,4 | 4,5 | 59,1 |
| Levofloxacin | 37 | 32,4 | 2,7 | 64,9 |
| Chloramphenicol | 3 | 0,0 | 33,3 | 66,7 |
| Cotrimoxazol | 42 | 80,9 | 0,0 | 19,1 |
| Nitrofurantoin | 1 | 0,0 | 0,0 | 100,0 |
| Fosfomycin | 26 | 7,7 | 0,0 | 92,3 |

*Escherichia coli* has 88,6% resistant proportion for Ampicillin, 80.0% for Piperacillin and 60,0% of Ampicillin + Sulbactam. The antibiotic resistant proportion of β-lactam - Cephalosporin group were from 23,3% to 60,0%.

- The antibiotic resistance of Pseudomonas aeruginosa (n = 5)

*Pseudomonas aeruginosa* has 60.0% resistant proportion for đề β-lactam - Monobactam, 40 - 50,0% for β-lactam - Cephalosporin (3rd and 4th generation), 40.0% for Aminoglycoside group and 60.0% for Ciprofloxacin.

- The antibiotic resistance of Klebsiella pneumoniae

*Klebsiella pneumonia* is sensitive with β-lactam – Carbapenems antibiotic group (100%). The resistant rate of *Klebsiella pneumonia* to Ceftazidime and Amoxicillin + A.clavulanic was 25% and 50% respectively. *Klebsiella pneumonia* resisted to Tobramycine and cotrimoxazol with high proportions (66.7% and 75%).

- The total antibiotic proportion of the major bacteria caused gastrointestinal SWI: Those 5 major bacteria caused SWI has resisted to Gentamycin; there were 4 bacteria resisted to Amplicilin, Ceftazidime and Tobramycin. Amplicinlin and Cephalothine have a highest resistant proportion.

3.2.4. The factor related to the gastrointestinal SWI

Table 3.24: The relation between coexisting diseases and gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Coexisting diseases | SWI  n (%) | None SWI  n (%) | Total | OR (95%CI) |
| Positive | 35  (5,3) | 626  (94,7) | 661 | 1,73  (1,14 - 2,62) |
| Negative | 69  (3,1) | 2131  (96,9) | 2200 | 1 |

The SWI proportion in patients with coexisting diseases was higher (5.3%) than the other group with none coexisting diseases (3.1%). The statistically significant difference has the odds ratio of 1,73 (95%CI: 1,14 - 2,62).

Table 3.25: The relation between the preoperative hospital stay and the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Duration | SWI  n (%) | None SWI  n (%) | Total | OR (95%CI) |
| > 7 | 10  (2,0) | 497  (98,0) | 507 | 0,48  (0,25 - 0,94) |
| ≤ 7 days | 94  (4,0) | 2260  (96,0) | 2354 | 1 |

Patients stayed more than 7 days in the hospital before operation have 0.48 fold lower the risk of SWI in comparison with patients stayed les than 7 days , with 95% CI: 0.25-0.94.

Bảng 3.27: The relation between SENIC index and the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SENIC index | SWI  n (%) | None SWI  n (%) | Total | OR (95%CI) |
| 2 - 4 points | 88  (8,8) | 910  (91,2) | 998 | 11,16  (6,52 - 19,13) |
| 1 points | 16  (0,9) | 1847  (99,1) | 1863 | 1 |

Patients with 2-4 points SENIC have 11.16 fold higher risk of the SWI than patients with 1 point SENIC ; the statistically significant difference has 95%CI: 6,52 - 19,13; p < 0,05.

Table 3.28: The relation between the surgical history and the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Surgical history | SWI  n (%) | None SWI  n (%) | Total | OR  (95%CI) |
| No surgical history | 68  (3,2) | 2086  (96,8) | 2154 | 1 |
| Other surgical history | 6  (4,2) | 136  (95,8) | 142 | 1,35  (0,58 - 3,17) |
| Gastrointestinal surgical history | 30  (5,3) | 535  (94,7) | 565 | 1,72  (1,11 - 2,67) |

Patients who experienced gastrointestinal surgery have the proportion of SWI around 5.3%. This proportion was higher than in none surgical history group (3.2%). The statistically significant difference has the odds ratio of 1,72 (95%CI: 1,11 - 2,67; p < 0,05).

Table 3.29: The relation between the surgical form and the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Form of surgery | SWI  n (%) | None SWI  n (%) | Total | OR (95%CI) |
| Emergency | 64  (7,0) | 854  (93,0) | 918 | 3,57  (2,38 - 5,34) |
| Elective surgery | 40  (2,1) | 1903  (97,9) | 1943 | 1 |

The risk of SWI in emergency surgical patients was 3.57 times higher than in elective surgical patients (95%CI: 2,38 - 5,34; p < 0,05).

Table 3.30: The relation between surgery path and the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Surgery path* | Site infection  n (%) | No site infection  n (%) | Total | OR (95%CI) |
| Other paths | 22  (6.6) | 313  (93.4) | 335 | 2.10  (1.29 - 3.40) |
| White line of Toldt | 82  (3.2) | 2444  (96.8) | 2526 | 1 |

The proportion of site infection among patients with other surgery paths is 6.6%, higher than among patients with surgery in white line of Toldt (3.2%). The difference is statistically significant.

Table 3.31: The relation between the types of surgery the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Types of surgery | Site infection  n (%) | No site infection  n (%) | Total | OR (95%CI) |
| Clean, Clean-Infected | 28  (1.3) | 2103  (98.7) | 2131 | 1 |
| Infected | 25  (6.4) | 366  (93.6) | 391 | 5.13  (2.96 - 8.90) |
| Contaminated | 51  (15.0) | 288  (85.0) | 339 | 13.3  (8.25 - 21.43) |

There is a significantly higher risk of getting SWI among patients with infected surgery and contaminated surgery than those with clean or clean-infected surgery.

\* The relation between the types of surgical viscera and the gastrointestinal SWI

The surgical SWI accounts for 10.7%; 4.2% and 4.4% among patients with surgery in appendix; small intestin and liver, gallbladder, pancreas respectively. The proportion of SWI among the patients with above-mentioned surgery is significantly higher than those with stomach-duodenum surgery, p<0.05

\* The relation between the number of surgical visceras and the gastrointestinal SWI

The proportion of SWI among patients with surgery in two or more visceras (9.2%) is higher than those with surgery in one viscera (3.5%). The difference is statistically significant with OR=2.80 (95%CI: 1.06 – 6.94).

Table 3.34: The relation between the length of surgery and the gastrointestinal SWI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Length of surgery | Site infection  n (%) | No site infection  n (%) | Total | OR  (95%CI) |
| < 60 minutes | 9  (2.3) | 389  (97.7) | 398 | 1 |
| > 120 minutes | 22  (7.6) | 266  (92.4) | 288 | 3.58  (1.62 - 7.89) |

There is a risk of 3.58 fold higher of surgical site infection among the patients undergoing surgery in more than 120 minutes than those who with surgery less than 60 minutes (95%CI: 1.62 – 7.89; p < 0.05).

\* The relation between the quantity of leukocyte before surgery and the gastrointestinal SWI

The patients who have the amount of more than 10 thousand leukocytes/mm3 before surgery are at 3.12-fold higher risk of SWI than the patients with normal level of leukocyte. The difference is statistically significant with OR = 3.12 (CI 95%: 1.94-5.03)

\* Multi-variable Logistic regression of associated factors of the gastrointestinal SWI

Table 3.37: Multi-variable Logistic regression of associated factors of the gastrointestinal SWI

|  |  |  |
| --- | --- | --- |
| Factors | OR (95%CI) | p |
| Accompanied diseases | 1.55 (0.98 – 2.44) | > 0.05 |
| Waiting time before surgery > 7 days | 0.66 (0.31 – 1.42) | > 0.05 |
| SENIC ≥ 2 | 1.84 (0.62 – 5.49) | > 0.05 |
| Other surgery history | 1.06 (0.42 – 2.64) | > 0.05 |
| Gastrointestinal surgery history | 2.46 (1.46 – 4.16) | < 0.05 |
| Emergency surgery | 0.49 (0.24 – 1.01) | > 0.05 |
| Surgery not in white line of Toldt | 0.60 (0.32 - 1.14) | > 0.05 |
| Surgery on two or more visceras | 4.75 (1.59 - 14.21) | < 0.05 |
| Infected surgery | 4.44 (1.53 – 12.93) | < 0.05 |
| Contaminated surgery | 13.20 (4.57- 38.11) | < 0.05 |
| 60 – 120-minute surgery | 1.81 (0.86 – 3.80) | > 0.05 |
| > 120-minute surgery | 5.90 (2.0 – 17.43) | < 0.05 |
| Surgery in small intestin | 2.80 (1.11 - 7.05) | < 0.05 |
| Surgery in appendix | 4.96 (2.22 - 11.06) | < 0.05 |
| Surgery in colon | 0.85 (0.28 - 2.58) | > 0.05 |
| Surgery in rectum | 0.36 (0.05 - 2.89) | > 0.05 |
| Surgery in liver, gallbladder, pancreas | 3.47 (1.67 - 7.20) | < 0.05 |
| Leukocyte count > 10.000/mm3 | 1.41 (0.85 - 2.34) | > 0.05 |
| Leukocyte count < 4.000/mm3 | 1.18 (0.29 - 4.77) | > 0.05 |

The multi-variable logistic regression reveals some significantly associated factors of SWI, including gastrointestinal surgery history; surgery on two or more visceras; infected surgery; contaminated surgery; surgery lasts for more than 120 minutes; surgery in small intestin, appendix, liver, gallbladder, pancreas.

3.3. Evaluation of treatment of the gastrointestinal SWI

3.3.1. Antibiotic use in the gastrointestinal SWI treatment

- The number of antibiotics used in the gastrointestinal SWI treatment

After surgery, 100% of patients were treated with antibiotics. The majority of patients (34.6%) were treated with 3 kinds of antibiotics, following by the patients treated with 4 kinds of antibiotics (25.2%)

- Antibiotic use to treat the SWI before having result of antibiotic susceptability

Most of the patients (76.9%) were treated with Metronidazol before having the result of antibiotic susceptability. The proportions of patients treated with Amikacin, Cefoperazol+Sulbactam and Ceftriaxone were 42.3%, 35.2% and 30.8% respectively.

Table 3.40: Antibiotic use and susceptability result

|  |  |  |
| --- | --- | --- |
| Antibiotic use | Freq. | % |
| Match susceptability result | 40 | 59,7 |
| Not match susceptability result | 27 | 40,3 |
| *Total* | *67* | *100,0* |

59.7% of the patients were treated with the appropriate antibiotic that matched antibiotic susceptability result while the proportion of patients changed/added antibiotic due to the inappropriate antibiotics was 40.3%.

- Antibiotic use to treat the gastrointestinal SWI after having result of antibiotic susceptability (n=104)

After having result of antibiotic susceptability, 35.6% of the patients were treated with Metronidazol, 23.1% with Amikacin. Both Fosmicin and Meropenem were used in 9.6% of the patients. The same percentage of 5.8% was for Vancomycin and Imipenem.

3.3.2. Other therapy for treatment of the gastrointestinal SWI

After surgery, 100% of the patients were treated with suppliment therapy to enhance their physical status. 68.3% of the patients used swelling reducting drug. Medical band of all of the patients was changed for better treatment of site infection. The proportion of patients used polyesteramid band was 16.3%. The percentage of patients undergoing discontinuous suture cutting and re-surgery were 41.3% and 0.95% respectively.

3.3.3. Treatment result of SWI

- Post-surgery hospitalization time of patients with the gastrointestinal SWI: the average time was 18.65 + 11.22 days

- Treatment result of SWI: all patients (100%) have recovered from the SWI after having treatment.

Chapter 4

DISCUSSION

4.2. Causes and associated factors of gastrointestinal SWI

4.2.1. Proportion of gastrointestinal SWI

The study was conducted on 2861 patients undergoing gastrointestinal surgery. The results show that SWI occured in 3.6% of the patients. The result reveals the similarity with study of Pham Thuy Trinh et al (2010) at General Surgery Department of Ho Chi Minh Medicine –Pharmacy University which generated a proportion of 3% [37]

The table 3.8 shows that 60.6% of the patients got shallow SWI while 38.4% got deep infection; 1% got infection in the viscera and abdominal cavity. The proportion of site infection of clean-infected surgery was 1.4%, while the percentage of infected surgery was 6.4% and of contaminated surgery was 15.0%. The highest rate of site infection occured among patients with surgery in appendix, accounting for 10.7%. The proportion among those who undergo surgery in liver, liver, gallbladder, pancreas with 4.4%, 4.2% among small intestin surgery and 1.3% among colon surgery.

4.2.2. The causes of gastrointestinal SWI

# The pus samples collected from patients with SWI that have been cultured and isolated to detect the pathogens causing the infection, the proportion of bacteria-positive samples was 64.4% (Table 3.11). The similar results found in study of Nguyen Quoc Anh (2008) with the isolated bacteria proportion of 63.9% [3]. Most of the pathogens was gram-negative (83.3%); 15.3% was gram-positive bacteria. Previous studies also indicated the higher percentages of gram-negative bacteria causing surgical site infection than gram-positive bacteria did [11]. The similar results were shown in study of Tran Do Hung et al (2013) at Can Tho General Hospital that most of the surgical site infection caused by gram-negative bacteria (71.9%); only 28.1% caused by gram-positive bacteria [21].

# The most popular bacteria causing SWI were *Escherichia coli* (61.1%); following by Pseudomonas aeruginosa (6.9%) and Klebsiella pneumonia (5.6%). Enterobacter cloacae; Enterococcus spp. and Streptococcus group B similarly accounted for 4.2%. Other bacteria were responsible for 1.4% of the cases (Table 3.13). In the study of Nguyen Quoc Anh et al (2008), Escherichia coli caused 39.6% of the infection; caused by Klebsiella pneumonia, Pseudomonas aeruginosa, Staphylococcus aureus with 16.7%, 10.4% and 9.4% respectively [[3](#_ENREF_3" \o "Anh, 2008 #91)].

**4.2.3. Characteristic of antimicrobial resistant bacteria causing gastrointestinal SWI**

The study results (Table 3.14) show the high proportions of antimicrobial and antimulti-microbial resistant *Escherichia coli.* 88.6% of *Escherichia coli* resisted against Ampicillin, 80.0% against Piperacillin. 23.3% - 60.0% resisted against β-lactam – Cephalosporin; 44.4% against Amoxicillin + A.clavulanic; 27.3% against Gentamycin; about 30% against Fluoroquinolon and 80.9% against Cotrimoxazol.

Study also reveals that 60.0% of *Pseudomonas aeruginosa* resisted against β-lactam- Monobactam; 40- 50.0% against 3rd-4th generation of β-lactam – Cephalosporin; 40.0% against Aminoglycosid and 60.0% against Ciprofloxacine (Table 3.15). There was a significant increase in the antimicrobial resistance.

It is remarkable that 100% *Klebsiella pneumonia* resisted against Cephalothine; 25% against Ceftazidime and Ceftriaxone; 50% against Amoxicillin + A.clavulanic; 66.7% against Tobramycin and 75% against Cotrimoxazol. *Klebsiella pneumonia* was still susceptible to β-lactam – Carbapenems; Piperacillin + Tazobactam; Cefoperazol + Sulbactam; Amikacine and Levoflocacin (Table 3.16)

4.2.4. Associated factors of gastrointestinal SWI

Bivariable analysis reveals 14 risk factors of surgical wound infection, including accopanied diseases, waiting time prior to surgery >7 days, SENIC >2; gastrointestinal surgery history; emergency surgery; surgery path not in white line of Toldt; surgery in various visceras; surgery on infected+contaminated wound; surgery in small intestin; surgery in appendix or due to the implications of appendix; surgery in liver, gallbladder, pancreas; the leukocyte count higher than 10 thousand/mm3; length of surgery >120 minutes.

Multi-variable logistic regression indicates 8 statistical significant risk factors: including gastrointestinal surgery history (OR = 2.46; 95%CI: 1.46 – 4.16); surgery in 2 or more visceras (OR = 4.75; 95%CI: 1.59 – 14.21); infected surgery (OR = 4.44; 95%CI: 1.53 – 12.93); contaminated surgery (OR = 13.20; 95%CI: 4.57 – 38.11); surgery in or more than 120 minutes (OR = 5.90; 95%CI: 2.0 – 17.43; p < 0.05); surgery in small intestin (OR= 2.80; 95%CI: 1.11 – 7.05); surgery in appendix (OR= 4.96; 95%CI: 2.22 – 11.06); surgery in liver, gallbladder, pancreas (OR= 3.47; 95%CI: 1.67 – 7.20).

4.3. Evaluation of treatment of gastrointestinal surgical wound infection

4.3.1. Treatment methods of gastrointestinal SWI

4.3.1.1. Antibiotic use in gastrointestinal surgical site infection

Our study shows that 100% of the patients were provided with antibiotic after the surgery (Table 3.38). The results were similar to the study of Hoang Hoa Hai et al (2001) with 99.7% of the patients used antibiotic after surgery [14].

Post-surgery, most of the patients (34.6%) used 3 kinds of antibiotic at the same time; following by 25.2% of patients used 4 kinds of antibiotic and then 14.4% used 2 kinds of antibiotic. The results of antibiotic susceptability show that 59.7% of the patients received appropriate antibiotic that matched the susceptability result convincing good capacity of doctors in Bach Mai Hospital. However, the second cause of SWI is the overuse of antibiotic, especially broad-spectrum antibiotics.

After having the result of antibiotic susceptability, the proportion of patients used Metronidazol was 35.6%, Amikacin was 23.1%, Fosmicin and Meropenem were similarly 9.6%, Vancomycin and Imipenem, Cilastatin were of the same percentage of 5.8%

4.3.2. Treatment result of surgical wound infection

Our study shows that the average hospitalization time of the patients was 18.65 + 11.22 days (Table 3.43). 100% of the patients recovered from the wound infection and had good status (clinical and subclinical) at the time of discharge.

CONCLUSION

The study was conducted on 2861 patients undergoing gastrointestinal surgery that provides the following results:

1. Proportion, causes and some associated factors of gastrointestinal surgical wound infection at the Department of Surgery, Bach Mai Hospital, 2011-2013

- Proportion of gastrointestinal surgical wound infection at the Department of Surgery, Bach Mai Hospital, 2011-2013 was 3.6%, including:

+ Shallow infection was 60.6% and deep infection was 38.5%

+ Site infection among patients with clean-infected surgery was 26.96; among infected surgery was 24.0% and contaminated surgery was 49.0%

- Proportion of bacteria isolated from the clinical samples was 64.4%, including:

+ Samples with only 1 pathogens causing wound infection accounted for 92.5%; samples with 2 pathogens computed 7.5%.

+ Gram-negative bacteria accounted for 83.3% of bacteria causing wound infection while it was 15.3% and 1.4% for gram-positive bacteria and fungi respectively.

- 61.1% of the wound infections were caused by *Escherichia coli* which resisted with a number of antibiotics including 88.6% of Ampicillin, 80.0% of Piperacillin, 50.0% of Methicillin, 23.4%-60.0% of β-lactam – Cephalosporin, >30.0% of Fluoroquinolon and 80.9% of Cotrimoxazol

- 6.9% of the wound infection caused by Pseudomonas *aeruginosa.* 60.0% of *Pseudomonas aeruginosa* isolated from the clinical samples resisted to β-lactam – Monobactam, 40-50% resisted 3rd – 4th generation β-lactam - Cephalosporin

- 5.6% of the surgical wound infection caused by *Klebsiella pneumonia*; 4.2% caused by *Enterobacter cloacae*; *Enterococcus spp.* và *Streptococcus group B*.

- Some major associated factors of gastrointestinal surgical wound infection include gastrointestinal surgery history; surgery in two or more visceras; infected surgery; contaminated surgery, length of surgery of more than 120 minutes; surgery in small intestin; surgery in appendix or due to implications of appendix; surgery in liver, gallbladder and pancreas.

2. Treatment result of gastrointestinal surgical wound infection at Surgery Department, Bach Mai Hospital, 2011-2013

- 100% of patients with surgical wound infection in gastrointestinal surgery were treated and recovered.

- 100% of patients got the replacement in medical band, provision of antibiotics and enhancement in physical status. 41.3% got the discontinuous suture cutting, 0.95% re-surgery, 16.3% used polyesteramid medical band.

- 59.7% of the patients were treated with appropriate antibiotics that matched antibiotic susceptability result.

- 51.0% of the patients were treated in 10-19 days (the average duration was 18.65 +11.22 days)

RECOMMENDATION

- It is necessary to detect, treat early for the patients with gastrointestinal surgical wound infection who had gastrointestinal surgery history, patients with infected and contaminated surgery; and surgery in or more than 120 minutes.

- It is recommended that antibiotic susceptability test should be performed among patients with early indicators of surgical wound infection or those who at higher risk of the infection. In case, there has not been the test result, the doctors are recommended to use gram-negative specific antibiotics like Metronidazol.

- It is recommended that β-lactam - Pelicillins; Aminoglycoside and some of β-lactam - Cephalosporin should not be used for patients with gastrointestinal surgical wound infection, such as Gentamycin, Ampicillin, Ceftazidime, and Tobramycin.