

# EFFECT OF INITIAL ANTIBIOTIC THERAPY IN PATIENTS WITH BLUNT ABDOMINAL TRAUMA

## Abstract

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### Background

Practising the use of antibiotics in emergency surgeries drastically reduces the incidence of post-operative systemic and surgical site infections. There are very few articles about the details of use of antibiotics in abdominal trauma. We studied the effect of preliminary drugs therapy against bacteria in patients with abdominal trauma.

### Methods

From May 2020 to May 2021, we looked back and surveyed the medical files of patients with abdominal trauma in our institution, Krishna institute of medical sciences deemed to be university, Karad. Blunt and piercing abdominal injuries were included in our study

### Results

Data of the 432 patients were accumulated. Antibiotic was initiated in 96.4% of penetrating injury and 79.7% with blunt injury. Initial antibiotics therapy was provided to 78.2% of patients with solid organ injury and 97.5% with hollow viscus injury. On an average of 6 days, antibiotics were given in solid organ injuries, 6.2 days in hollow viscus. Infection within 2 weeks of admission occurred in 50 cases. Infection linked severity of injury, surgery performed and blood transfused. Time for which the antibiotic was given did not affect the rate of infection.

### Conclusion

It was inferred that the antibiotics were used in massive numbers (84.2%) and for prolonged time (6.2 days) in these patients in Karad.

**Key words:** Blunt abdominal trauma, antibiotic therapy, surgical site infections

## INTRODUCTION

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Distressing injuries are one of the most common causes of death, reporting 5 million deaths annually all over the world. Mortality in trauma shows trimodal peaks with the third peak occurring at a later time after injury, which is about 20% of all trauma deaths [1]. Infection is summoned as a major reason for mortality in the third peak, and abdominal trauma is summoned as a common cause of unrecognized deaths.

Pre and peri operative use of antibiotics is essential in reducing the numbers of SSI and practical guidelines for antimicrobial prophylaxis in surgery are well known [2]. However, the number of significant articles about abdominal trauma are very less [2,3]. Recent study says, for abdominal trauma, without hollow viscus perforation, no requirement to administer a different antibiotic other than the one used as preoperative prophylaxis, can be given for 1 day in the presence of a hollow viscus injury [1,3].

Even though many surgeons are using prophylactic antibiotics, no studies have investigated the type of antibiotics and duration of therapy in patients with abdominal trauma in Karad. Hence this study is

being carried out as the initial study before applying the guidelines about the use of antibiotics for abdominal injuries.

## METHODS

From May 2020 to May 2021, the medical records of patients with abdominal trauma in our institution, Krishna institute of medical sciences deemed to be university, Karad were surveyed retrospectively. Injured organ and degree of injury were initially assessed by E-FAST sonography and after stabilising the patient, and then confirmed by abdominal and pelvic CT or surgery. Open and closed abdominal injuries were included in the study. We excluded patients who were brought dead, those who were below 15 years, those who died within 24 hours of admission, and those with pre-existing, untreatable diseases, such as cancer.

We also studied the following; if the surgery was open or closed and the time taken for it. Intra operatively injury assessed thoroughly. The whole of GI tract was included except oesophagus and anal canal.

The type and extent of infection that occurred within 1 week of surgery was assessed. The types of infection were catalogued into superficial and deep SSI, organ SSI, and non-SSI, and were systematized into various categories. The causative bacteria were identified by culturing the pus from the site of infection, in case of superficial; and deep SSI, and blood in case of non-SSI along with the antibiotic sensitivity of that organism. Accordingly, when the antibiotic was changed the response was assessed.

## RESULTS

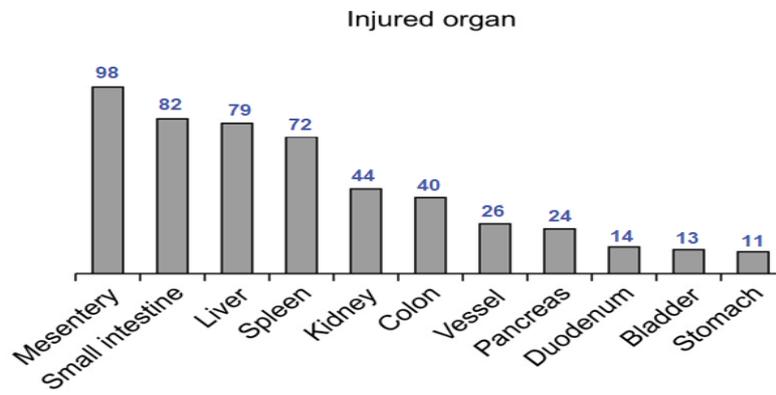
Data of the 432 patients were collected from the department of surgery, unit 2, KIMS DU. The average age of the subjects was 44 years, and 75.2% were of male gender. The average abdominal AIS was 3, and the NISS of the abdomen was 9. Approximately 73% of patients (n = 315) presented with an blunt trauma. The median time between the start of antibiotics and the patient arrival was 2.1 hours ([Table 1](#)).

**Table 1: Patient's characteristics**

Characteristics	Data
No of patients	432
Age in years	44 (28-57)
Male Sex	325 (75.2%)
Time from arrival to 1 <sup>st</sup> Antibiotic therapy in Hours	2.1 (1.1-4.8)
Initial Systolic Blood Pressure in mmHg	100 (85-115)
AIS (abdomen)	3 (2-3)
NISS (abdomen)	9 (4-13)
Blunt trauma	315 (73%)
Hollow viscus perforation	92 (21.2%)

AIS- Abbreviated Injury Scale; NISS- New Injury Severity Score

The commonest organ injured was the mesentery (22.8%), followed by the small intestine (19.0%), liver (18.3%), spleen (16.7%), and kidney (10.3%) ([Fig. 1](#)).



**Fig. 1 : Injured Organs**

Based on the mechanism of injury, antibiotic was started in 96.4% of patients with penetrating injury and 79.7% with blunt injury. Based on the most damaged organ, first antibiotic therapy was provided to 78.2% of patients with solid organ injury and 97.5% with hollow viscus injury, and antibiotics were used in all cases of both solid and hollow viscus injuries ([Table 2](#)).

**Table 2: Use of Antibiotics**

Variable	Use of antibiotics	Duration (Days)
Total	364/432 (84.2%)	6.2 ± 4.3
Mechanism – Penetrating	113/117 (96.4%)	5.5 ± 3.5
Mechanism – Blunt	251/315 (79.7%)	6.6 ± 4.6
Organ – Solid	239/306 (78.2%)	6.0 ± 3.6
Organ – Hollow viscus	55/56 (97.5%)	6.2 ± 4.9
Organ – Both	70/70 (100%)	7.2 ± 5.6
Perforation	92/92 (100%)	6.1 ± 4.3
Perforation upto small intestine	75/75 (100%)	6.3 ± 5.2
Perforation upto Colon	27/27 (100%)	6.7 ± 2.8

Antibiotics were used in 239 cases of solid organ injuries. 70.5% of patients with solid organ injuries received Cephalosporin and 87.5% were with hollow viscus injuries. Most commonly used cephalosporin was second and third-generation drugs. On an average of 6 days antibiotics were used in solid organ injury, 6.2 days of antibiotic therapy was given to hollow viscus injury and 7.2 days of therapy for both the injuries. ([Table 3](#)).

**Table 3: Details of Antibiotics Used**

Antibiotic	Solid (n=306)		Hollow viscus (n=56)		Both (n=70)	
	No (%)	Duration (day)	No (%)	Duration (day)	No (%)	Duration (day)

Cephalosporin	215(70.5)		49(87.5)		59(84.3)	
First generation	42(13.6)		6(10.0)	4.5 ± 2.9	8(11.8)	5.7 ± 2.9
Second generation	77(25.0)	5.4 ± 3.4	22(40.0)	6.9 ± 6.9	18(25.5)	5.8 ± 3.5
Third generation	97(31.8)	6.5 ± 3.8	21(37.5)	6.1 ± 2.9	33(47.1)	8.3 ± 6.5
Quinolone	11(3.6)	8.0 ± 4.8	1(2.5)	1.0 ± 0.0		
Piperacillin/tazobactam	14(4.5)	7.1 ± 5.1	6(10.0)	5.0 ± 2.9	7(9.8)	9.4 ± 8.6
Aminoglycoside	3(0.9)	4.0 ± 4.2			0(0.2)	2.0 ± 0.0
Anaerobes	44(14.5)	8.3 ± 4.2	25(45.0)	5.2 ± 2.9	37(52.9)	7.5 ± 5.4
Others	2(0.5)	3.0 ± 0.0	3(5.0)	8.0 ± 4.2	3(3.9)	4.0 ± 0.0
Total	239(78.2)	6.0 ± 3.6	55(97.5)	6.2 ± 4.9	70(100)	7.2 ± 5.6

3rd generation cephalosporin (44.0%) were used more commonly than the 2nd generation cephalosporin (33.1%) (Table 4).

There was no much change in the in the lowest SBP in patients with or without antibiotics; however, the AIS, NISS, and the amount of RBC transfusions were higher in the patients with antibiotic therapy. Also the duration of ICU stay was much higher in the patients with antibiotic therapy (Table 4).

**Table 4: Antibiotic use and different study parameters**

Feature	Antibiotic use (n=364)	No antibiotics (n=68)	P -value
Lowest SBP (mmHg)	111.0 ±81.1	116.9 ±21.6	0.614
AIS(abdomen)	2.7±1.0	2.0 ± 1.0	<0.001
NISS (abdomen)	10.1±8.0	6.0 ± 6.6	<0.001
RBC transfusion(unit)	2.8±5.0	0.1 ± 0.6	<0.001
ICU stay (day)	3.0±5.2	1.1 ± 1.3	<0.001
Hospital stay (days)	14.4±15.7	6.8 ± 4.5	<0.001
Infection within 2 weeks	36(13.7)	0(0)	0.006
mortality	8(3.1)	0(0)	0.195

AIS- Abbreviated Injury Scale ;  
NISS- New Injury Severity Score ; SBP – Systolic Blood Pressure ;  
RBC – Red blood cells ;  
ICU- intensive care unit

Infection within 2 weeks of admission occurred in 50 cases. Among these, comparison was made between the features with and without infection. Infection was related to injured organs, whether the surgery was performed or not, the presence of open abdomen, and exposed injury of the GI tract (Table 5). Infection not seen in all 19 cases of which underwent laparoscopic surgery.

**Table 5: Different features of patients and infection rates**

Feature	Infection (n=50)	No infection (n=382)	p-value
Mechanism			0.773
Penetrating	13(25.0)	104(27.3)	

Blunt	38(75.0)	278(72.7)	
Injured organ			<0.001
Solid	21(41.7)	285(74.5)	
Hollow viscus	10(19.4)	46(12.0)	
Both	20(38.9)	52(13.5)	
Initial SBP (mmHg)	90.0 ± 28.2	114.3 ± 86.1	0.101
Operation			<0.001
Op	45(88.9)	199(52.0)	
Not op	6(11.1)	183(48.0)	
Laparoscopic surgery	0(0)	19(5.1)	<0.001
Open abdomen	11(22.2)	22(5.8)	0.001
Perforation	20(38.9)	72(18.9)	0.006
Colon perforation	10(19.4)	18(4.7)	0.001
AIS (abdomen)	3.4 ± 1.0	2.5 ± 1.0	<0.001
NISS (abdomen)	17.7 ± 12.2	8.4 ± 6.6	<0.001
RBC transfusion (unit)	6.5 ± 8.5	2.2 ± 3.9	0.007
Duration of antibiotics (day)	6.3 ± 5.3	6.2 ± 4.1	0.892
Hospital stay (day)	30.2 ± 28.4	10.9 ± 9.9	<0.001
ICU stay (day)	8.6 ± 10.5	1.9 ± 2.6	0.001
Mortality	3 (5.6)	8(2.6)	0.429

## DISCUSSION:

We researched the incidence of infections in patients with abdominal trauma who received the preliminary antibiotic therapy, in KIMS DU, Karad. While doing this research, we found that the rate of antibiotics uses in KIMS DU is overly high and administered for prolonged time, and the time of first dose is adjourned. 84.2% of the patients who participated in the study received antibiotic therapy for an average period of 6.2 days. More patients with penetrating injury received antibiotic therapy as compared to the one with blunt injury, and also for a prolonged period.

Goldberg et al. [1]. In their studies prophylactic antimicrobials have shown an important role in decreasing infection in patients with penetrating wounds of the abdomen when associated with an injury to a hollow viscus. Numerous studies demonstrate the importance of broad-spectrum aerobic and anaerobic coverage. In our study, antibiotics was inoculated about 6 hours of visiting hospital and given for 6.2 days. However, there was no much variation in infection based on the duration of antibiotics. It is advisable to administer the antibiotic dose as early as the patient arrives to the hospital.

There are many studies specifically on penetrating injuries but have no mention about blunt trauma on solid organs. In our study, antibiotics were given in 78.2% of patients with solid organ injury. In most studies, the conclusions have been very indecisive regarding either the effect or the duration of use of antibiotics for penetrating abdominal trauma on abdominal surgical site infection rates, mortality, or intra-abdominal infections. [3]. However, in this study, antibiotics are given for more than 6 days irrespective of the mode of injury. It can be concluded that we should reduce unnecessary prolonged use of antibiotics especially in mild blunt traumas.

Initial preferred antibiotics are broad spectrum as it can be used against both aerobic and anaerobic. [4]. Second-generation cephalosporin is advised holding the third-generation cephalosporin is a replacement [2,5]. 31.5% of patient who took part in our study received 3<sup>rd</sup> generation cephalosporin and 25% of them were given with 2<sup>nd</sup> generation cephalosporin. Hence there is high obligation to the usage of appropriate antibiotic in a patient with abdominal trauma.

It is observed in this study that the infection rate in hollow viscous injury as compared to the solid organ injury, is much higher with AIS score more than 3, which implicates the use of antibiotic irrespective.

Open surgeries showed the incidence of infections higher than the laparoscopic surgeries, in turn increasing the unnecessary use of antibiotics, and also involved RBC transfused on an emergency basis as the blood loss was more compared to laparoscopic surgeries, it was also observed that the RBC transfused on an emergency basis had higher infection rate than the elective transfusion. Hence the latter to be considered whenever possible and is not contraindicated. [6,7]

This study was a retrospective study and has numerous drawbacks. There were many difficulties such as identifying cause of infection, method of administration of antibiotics, the way in which the data is document and how delicately it is recorded by the institution. Due to lack of data on the factors that caused the infection post-surgery, it was difficult to draw a relation between the use of antibiotic and the outcome of the same in various infections. Use of antibiotics based the guidelines given [6] should be emphasized, if not giving according to that, changes should be made accordingly.

EE Cornwell et al [8] found that there was no any evidence that extending antibiotic prophylaxis beyond 24 hours postoperatively is of any additional benefit, even among the highest risk patients with penetrating abdominal trauma. And they recommended a large multicentric trial to further confirm their hypothesis. Awad S et al [9] mentioned that along with antibiotic coverage patients can be managed with laparoscopy instead of laparotomy which has advantages of less morbidity, postoperative discomfort and earlier recovery. Many other authors suggested judicious use of antibiotics in patients with blunt abdominal trauma. [10-12] Some even suggested to use antibiotics for preventing possible peritonitis post blunt abdominal trauma or post-operative procedures [13, 14]

## **CONCLUSION:**

Our study concludes that the use of antibiotics in patients with abdominal surgery is very extensive and is for prolonged duration. Cephalosporins, to specify the third and the second generation, are the most commonly used drugs as the prophylactic antibiotic. Single dose of appropriate choice of antibiotic as soon as the patient with hollow viscous injury, visits the hospital and right before surgery. Perform laparoscopic surgery whenever possible and is not contraindicated, as the rate infection is much lesser. In patients with AIS score 3 or more, or in patients with blood transfusion, even with no hollow viscous injury or surgery, antibiotics should be considered.

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## **REFERENCES:**

- 1- Goldberg SR, Anand RJ, Como JJ, Dechert T, Dente C, Luchette FA, Ivatury RR, Duane TM.

Prophylactic antibiotic use in penetrating abdominal trauma: an Eastern Association for the Surgery of

- Trauma practice management guideline. *Journal of Trauma and Acute Care Surgery*. 2012 Nov 1;73(5):S321-5.
- 2- Herrod PJ, Boyd- Carson H, Doleman B, Blackwell J, Williams JP, Bhalla A, Nelson RL, Tou S, Lund JN. Prophylactic antibiotics for penetrating abdominal trauma: duration of use and antibiotic choice. *The Cochrane Database of Systematic Reviews*. 2019 Dec;2019(12).
  - 3- Brand M, Grieve A. Prophylactic antibiotics for penetrating abdominal trauma. *The Cochrane database of systematic reviews*. 2019 Dec 12;12(12):CD007370.
  - 4- Hospenthal DR, Murray CK, Andersen RC, Bell RB, Calhoun JH, Cancio LC, Cho JM, Chung KK, Clasper JC, Colyer MH, Conger NG. Guidelines for the prevention of infections associated with combat-related injuries: 2011 update: endorsed by the Infectious Diseases Society of America and the Surgical Infection Society. *Journal of Trauma and Acute Care Surgery*. 2011 Aug 1;71(2):S210-34.
  - 5- Jang JY, Kang WS, Keum MA, Sul YH, Lee DS, Cho H, Lee GJ, Lee JG, Hong SK. Antibiotic use in patients with abdominal injuries: guideline by the Korean Society of Acute Care Surgery. *Annals of Surgical Treatment and Research*. 2019 Jan 1;96(1):1-7.
  - 6- Kumar S, Gupta A, Sagar S, Bagaria D, Kumar A, Choudhary N, Kumar V, Ghoshal S, Alam J, Agarwal H, Gammangatti S. Management of Blunt Solid Organ Injuries: The Indian Society for Trauma and Acute Care (ISTAC) Consensus Guidelines. *Indian Journal of Surgery*. 2021 Apr;83(1):3-41.
  - 7- Martino C, Russo E, Santonastaso DP, Gamberini E, Bertoni S, Padovani E, Tosatto L, Ansaloni L, Agnoletti V. Long-term outcomes in major trauma patients and correlations with the acute phase. *World journal of emergency surgery*. 2020 Dec;15(1):1-7.
  - 8- Cornwell EE, Dougherty WR, Berne TV, Velmahos G, Murray JA, Chahwan S, Belzberg H, Falabella A, Morales IR, Asensio J, Demetriades D. Duration of antibiotic prophylaxis in high-risk patients with penetrating abdominal trauma: a prospective randomized trial. *Journal of Gastrointestinal Surgery*. 1999 Dec;3(6):648-53.
  - 9- Awad S, Dawoud I, Negm A, Althobaiti W, Alfaran S, Alghamdi S, Alharthi S, Alsubaie K, Ghedan S, Alharthi R, Asiri M. Impact of laparoscopy on the perioperative outcomes of penetrating abdominal trauma. *Asian Journal of Surgery*. 2022 Jan 1;45(1):461-7.
  - 10- Fabian TC, Hoefling SJ, Strom PR, Stone HH. Use of antibiotic prophylaxis in penetrating abdominal trauma. *Clinical Therapeutics*. 1982 Jan 1;5:38-47.
  - 11- Delgado Jr G, Barletta JF, Kanji S, Tyburski JG, Wilson RF, Devlin JW. Characteristics of prophylactic antibiotic strategies after penetrating abdominal trauma at a level I urban trauma center: a comparison with the EAST guidelines. *Journal of Trauma and Acute Care Surgery*. 2002 Oct 1;53(4):673-8.
  - 12- Gandhi A, Sharma R, Sinha DK. Characteristics of hollow viscus injury following blunt abdominal trauma: A study done in Rajendra institute of medical sciences. *International Journal of Surgery*. 2019;3(2):135-8.
  - 13- Mohapatra S, Pattanayak SP, Rao KR, Bastia B. Options in the management of solid visceral injuries from blunt abdominal trauma. *Indian J surg*. 2003 May 1;65(3):263-8.
  - 14- Khakhkhar T, Shah R, Hemavathi KG. Current status of post-operative antibiotic prophylaxis in surgical wards. *National Journal of Physiology, Pharmacy and Pharmacology*. 2016;6(6):622-6.

