EFFICACY OF ANTIBIOTIC PROPHYLAXIS FOR PREVENTING INTRATHORACIC INFECTIONS AFTER THORACOSTOMY FOR TRAUMATIC HAEMO/PNEUMOTHORAX – EXPERIENCE OF ORADEA COUNTY EMERGENCY HOSPITAL

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EFFICACY OF ANTIBIOTIC PROPHYLAXIS FOR PREVENTING INTRATHORACIC INFECTIONS AFTER THORACOSTOMY FOR TRAUMATIC HAEMO/PNEUMOTHORAX – EXPERIENCE OF ORADEA COUNTY EMERGENCY HOSPITAL (Abstract): The aim of the paper is to observe the effectiveness of prophylactic administration of antibiotics against empyema and pneumonia after tube thoracostomy for traumatic collections. Material and methods: Observational retrospective study over a ten years period (2002-2011), at the Oradea County Emergency Hospital on 939 patients with chest tube drainage for traumatic haemo/pneumothoraces. The morbidity by intrathoracic infections was 5.5% in the curative antibiotic group. Results: The median number of risk factors for surgical infections and case severity were not statistically different (p=0.9653 and p=0.6601) between cases with antibioprophylaxis and curative treatment, but the incidence of intrathoracic infection in the prophylaxis group (n=86) was half (2.3%). Antibiotic prophylaxis was effective in over 95% of the cases and it associated in-hospital length of stay, length of stay in the ICU and costs of care significantly (p<0.0001, p<0.0001, p=0.0046) lesser than of those patients treated with curative regimen. The overall mortality was 8.6% within the curative regimen group with an attributable mortality to infections of 17.39%; but it was only 2.3% and respectively 0 within the prophylaxis group. Conclusions: Antibiotic prophylaxis for intrathoracic infections after tube thoracostomy for traumatic collections was justified by case severity and risk factors and was effective and cost-efficient, but it should be administered selectively. Keywords: ANTIBIOPROPHYLAXIS, TUBE THORACOSTOMY, TRAUMA, INTRATHORACIC INFECTIONS.

The literature oscillates between the opinion that antibioprophylaxis after tube thoracostomy for traumatic collections lowers the incidence of empyema and pneumonia(1) as opposed to non-administration of antibacterials, and the finding that administered before, during or after tube thoracostomy the antibacterials do not change the outcome(2). Some authorities consider that the level of evidence is good enough to recommend prophylaxis for pneumonia, but not for empyema (3). More recent studies are encouraging the use of prophylaxis by some institutions; meanwhile others remain very selective with this indication (4, 5). The benefit from the antibacterial must be
significant, because of the risk of bacterial resistance generation and dissemination with excessive use of antibacterial drugs (6).

**MATERIAL AND METHODS**

The study is a retrospective observational review over ten years (2002-2011) conducted in the Emergency County Hospital Oradea, on all admitted trauma patients who underwent tube thoracostomy for haemo/pneumothorax, exclusively on those who needed urgent thoracostomy in the first 48 hours. We identified the risk factors for infection after a selected (7, 8, 9, 10, 11) list (COPD, TB, diabetes mellitus, heart diseases, liver diseases, renal diseases, neoplasms, alcohol consumption, obesity, age over 65 years, leucocytosis, polytrauma, multiple rib fractures or flail chest, more than one chest drain) and their association with antibacterial prescriptions, surgical procedures, intrathoracic infections (pneumonia/empyema) and with mortality. We retrospectively noticed the prescribing and non-prescribing of antibacterial drugs and pneumonia and/or empyema developing after 48 hour from tube thoracostomy. We considered as prophylactic regimen the prescribing of one antibacterial drug in one or two doses or at most for 24 hours, and as curative regimen, the prescribing of one antibacterial for more than 24 hours or the prescribing of more than one antibiotic drug. We compared the inhospital length of stay, the length of stay in the ICU, the morbidity by intrathoracic infections and the mortality, respectively after the prophylactic administration, the curative administration and the non-administration of antibacterial drugs.

As the dedicated trauma severity scores (AIS, ISS) were used neither in prehospital nor in the hospital settings and as also the physical/physiological status scores (ASA, APACHE) were not consistently evaluated in all patients, we assessed the severity of cases as the presence of serious traumatic lesions in more than one anatomical region of the body (polytrauma).

The statistical analysis was performed with the MedCalc program, version 9.4.3.0 (MedCalc Software, Mariakerke, Belgium). The results were represented as the ‘null’ hypothesis presence probability \( p \), with the \( p \) value \(< 0.05\) proving the statistical significance of the difference between variables.

**RESULTS**

In our hospital, between 01.01.2002 and 31.12.2012 were admitted 939 patients with thoracic trauma who underwent closed chest tube thoracostomy with the intent of definitive treatment for haemo/pneumothoraces. Ninety-eight percent of the patients suffered a blunt chest trauma (n=922). Most of the 654 patients (70%) were prescribed antibacterial drugs in curative regimen; 86 of them (9%) were prescribed antibiotics in prophylactic regimen, and 199 (21%) received no antibacterial agents. But only 78 of 654 (12%, \( p<0.0001 \) Chi-square test) of those who received antibacterial agents in curative regimen had a diagnosis of infection or solid evidence of infection documented in their paper forms, such as the presence of pus in respiratory aspirates or pleural fluid, the identification of pathogen strains in the biologic specimens, or sensitivity test results.

The logistic regression analysis showed that two risk factors were statistically significant associated with the antibiotic prescription (n=740): leucocytosis \( [OR 4.3584 (CI 95\%: 2.05-9.26) p=0.0001] \) and polytrauma \( [OR 1.9032 (CI 95\%:1.22-2.96) p=0.0045] \).
Efficacy of antibiotic prophylaxis for preventing intrathoracic infections after thoracostomy

Morbidity. We found 42 septic complications (21 pneumonias and 21 empyemas) in 40 patients (4.24%), with 2 patients associating both of the infections. Of all 40 infected cases, 34 (85%) were cured by treatment and 6 died (15%). In the non-antibiotic group of patients (n=199), 2 manifested empyema, and 2 of those who received antibiotic prophylaxis also suffered of intrathoracic infections after the pleural drainage. The rest of 36 of the infected patients (90%) belonged to the curative antibiotic group. The infectious morbidity with pneumonia/empyema in the curative group was 5.5%, in the prophylaxis group was 2.3% and in the non-antibiotic group was 1%. The patients with septic complications had longer mean hospital stay: 18 days (CI 95%:14.5-21.5) comparative to 9 days (CI 95%:8-9) (p<0.0001 Mann-Whitney test), and median costs of care higher than uninfected patients: 5184RON (CI 95%: 2303-8616) comparative to 2588 RON (CI 95%: 2445-2769). (p<0.0001 Mann-Whitney test). The retrospective analysis with logistic regression did not find the prophylactic or curative antibiotic prescribing to lower the risk for infection outcomes (pneumonia and empyema) (OR=0.4087; CI 95%: 0.09-1.72).

Mortality. There were 28 deaths (3%) in ten years. In the curative treatment group died the largest number (23 deaths) of patients (82%), 4 of those died with intrathoracic infections. The overall mortality in this group was 3.5%, and the specific mortality by intrathoracic infections was 17.39%. In the non-antibiotic group the overall mortality was 1.5% (3 deaths), with no deaths due to infections. In the prophylaxis group the overall mortality was 2.3% (2 deaths) and no specific infectious mortality. Among the patients with intrathoracic infections the mortality was 15%. Mortality was statistically significant more frequently associated with two risk factors: the polytrauma condition [OR=19.898; CI 95% (6.81-54) p=0.0001] and age over 65 years [OR=2.5080; CI 95% (1.06-5.88) p=0.0045].

Prophylaxis. Two patients in the prophylaxis group suffered intrathoracic infections and were converted to curative antibacterial regimen with successful recovery. Eighty-two of 86 of the patients with antibiotic prophylaxis (>95%) were discharged in good recovery. The median hospital length of stay of the prophylaxis patients was 7.5 days (CI 95% 7-8), the median length of stay in ICU was 1 day (CI 95% 1-1), and the cost of care was 2196 RON (CI 95%: 1879-2842) and all the three variables were significantly lesser than those for the curative group (p<0.0001, p<0.0001 and p=0.0046 respectively Mann-Whitney test). Although the prophylaxis patients also had lesser lengths of stay in the ICU than the non-antibiotic patients, the median cost of care did not significantly differ between the prophylaxis and non-antibiotic groups (p=0.1584 Mann-Whitney test).

DISCUSSION
Tube thoracostomy is the definitive treatment for 85-90% of the chest trauma patients (3, 4, 15). Trauma lowers immunity, jeopardizes tissues making them vulnerable to infection and contaminates spaces that are normally sterile. Thoracostomy itself may care intrathoracic infection either by procedural contamination or by missing complete evacuation of the pleural collections that secondary become infected (1, 3). The incidence of pneumonia and bacterial empyema after closed tube thoracostomy is reported as
2-35% and carries mortality as high as 30% (12, 13). Forty percent of the traumatic haemo-thoraces, complicated by respiratory insufficiency, empyema or fibrothorax will need thoracostomy with the associated morbidity (14, 15).

The curative prescribing of the antiba-
cterials is justified by infection or by pe-
netrating contaminated or grossly dirty wounds (16, 17, 18). In our hospital the prescribing of antibiotics is strongly associated with leucocytosis (neutrocyto-
sis) and with polytrauma. The risk of pre-
scribing antibiotics was 4.3 times higher in the presence of leucocytosis and 1.9 times higher in the presence of polytrauma. But it is well known the fact that trauma is an activator of the systemic and local inflam-
matory response and that the activation and mobilization in great numbers of inflamma-
tory white blood cells both in the circulato-
ry torrent and organs (affected or not by lesions), in trauma setting does not imply infection or antibacterial fight (16,17,19), without pertinent evidence of the presence and multiplication of bacteria. In these cases, white blood cell count based antibac-
terial prescribing is not justified without other arguments (19). Should the antibiotic be mandatory, only the prophylactic regi-
men was justified (20). The polytrauma setting by severity may involve not only ventilatory but also haemodynamic assisting or control, circumstances that may elicit preventing infection, but also only in a prophylactic regimen (16, 19, 20).

The incidence of one intrathoracic in-
festation at every 25 tube thoracostomies for trauma over ten years would intuitively demand 25 antibacterial prophylactic ad-
ministrations in order to avoid one infec-
tion. But actually it would be justified to select patients for prophylaxis instead of routine prophylaxis. In fact, the morbidity by empyema and pneumonia was 1% in the non-antibiotic group but more than double (2.3%) in the prophylaxis group which means more than superfluous prophylaxis. That is why the actual study suggests selec-
tive prophylaxis.

CONCLUSIONS

Antibiotic prophylaxis for intrathoracic infections after tube thoracostomy for traumatic haemo/pneumothoraces was justified in the presence of the risk factors and case severity and demonstrated efficacy and cost effectiveness.

Antibiotic prophylaxis in our hospital should be selective with this indication.

Unjustified antibacterial therapy in cura-
tive regimen must be abandoned because of the useless and long exposure of hospital pathogens to antibacterials, with emerging and dissemination of bacterial resistance. In trauma setting, the antibacterials are adju-
vants for the treatment, while in pneumonia they are the basic treatment, and the loss of the effectiveness of the basic treatment of nosocomial pneumonia would become (again) an immense danger concerning the actual mortality of 30% or more.

REFERENCES

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Efficacy of antibiotic prophylaxis for preventing intrathoracic infections after thoracostomy


