Iranian surgeons’ compliance with the American Society of Health-System Pharmacists guidelines: Antibiotic prophylaxis in private versus teaching hospitals in Shiraz, Iran

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Abstract
Objectives: To assess compliance with the American Society of Health-System Pharmacists (ASHP) guidelines of prophylactic antibiotic use in private hospitals in Shiraz, Iran.
Methods: This cross-sectional study was performed using prospective data gathered from April to September 2010 in the surgical wards of all private hospitals in Shiraz. Administrative data, patient characteristics, and antibiotic prophylaxis criteria were collected. Adherence to five criteria according to ASHP guidelines was evaluated: justification of the use of prophylactic antibiotics, appropriateness of the agent, dose, initiation time, and duration of the agent’s effect. Only if all of the above criteria were fulfilled would the individual be labeled as completely compliant. We used descriptive analysis, including frequencies, to evaluate the results.
Results: From April to September 2010, 365 patients from 63 surgical wards of eleven private hospitals were enrolled in our study. Prophylactic antibiotics were inappropriately given to 64.6% of patients. Twenty out of 26 patients did not receive an appropriate course of antibiotics. In cases requiring antibiotic prophylaxis per ASHP guidelines, antibiotic choice was concordant in 32 (25.4%) out of 126 procedures. In cases that required and received prophylactic antibiotics, the duration and initiation time of prophylaxis were concordant with the guidelines for 37 (29.4%) and 77 (61.1%) cases, respectively. The overall compliance with ASHP guidelines was 10.13%.

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Conclusions: Our study revealed that in private hospitals in Shiraz, Iran, approximately 90% of patients received inappropriate surgical prophylaxis. Practical measures to improve the implementation of guidelines are urgently needed.

Introduction

Surgical-site infections (SSIs) are a prevalent and grave complication following surgery [1,2]; SSIs significantly increase the length of hospital stay, morbidity and mortality [3] and subsequently drain healthcare system resources [4]. SSIs account for 9.96—42.7% of all nosocomial infections in Shiraz, Iran, increasing the length of hospitalization by 8.33 days [5,6].

In the last fifty years, many studies have shown that the appropriate administration of prophylactic antibiotics is effective in reducing the risk of SSIs [7—10].

According to well-established guidelines, the proper antibiotic/antimicrobial agent should protect against organisms causing surgical site infections, be initiated at the proper time (i.e. 30—60 min before incision), and be administered for no more than 24 h [11,12].

Several studies have been conducted to evaluate the rates of compliance with prophylactic guidelines with respect to antibiotic selection, initiation time, and duration of administration [4,13—17]. Despite the available guidelines, adherence to these practices is drastically low among surgeons.

Low compliance with guidelines increases antibiotic resistance, adverse events, and costs (up to 6 times) to the healthcare system [18].

Total compliance with prophylactic antibiotic guidelines has been reported to be variable but low worldwide, from less than 1% in Iran [4] and Korea [16] to 28%, 33.2%, 36.3% and 41.1% in Dutch [19], Malaysian [15], Greek [17] and French [14] reports, respectively.

In a study of patients receiving surgical antibiotic prophylaxis in teaching hospitals in Shiraz, Iran, 94% received inappropriate antibiotic agents, and 59.3% were not treated with appropriate dosing schedules. Surgical antibiotic prophylaxis duration was considered to be too long (unnecessarily prolonged) in 60.8% of the patients [18].

In contrast to teaching hospitals, private hospitals have no training for medical students or residents. Thus, private hospitals have fewer healthcare providers and less diversity in terms of drug prescription tendencies, especially with respect to antibiotics [20]. In addition, private hospitals often prefer to admit less complicated patients [21], and people of higher socioeconomic status usually prefer private hospitals. Therefore, we could not extend the results obtained regarding adherence to surgical prophylactic guidelines in teaching hospitals to private hospitals. It is expected that antibiotic prophylaxis administration in private surgical wards differs from that in teaching surgical wards.

To address the compliance with ASHP [22] guidelines of prophylactic antibiotics in private hospitals in Shiraz, Iran, we conducted this cross-sectional study.

Materials and methods

Setting

This was a cross-sectional, hospital-based study using prospective data collected from April to September 2010. Shiraz, the capital of Fars province, has 11 private hospitals with a total of 832 beds, of which 578 are surgical beds. All private hospitals agreed to participate in the study. We included patients from general surgery, gynecology, ear nose and throat (ENT) surgery, ophthalmology, neurosurgery, cardiac surgery, the orthopedic ward, urology, and plastic surgery.

Data collection

Patient charts were reviewed during the postoperative period while patients were still in the hospital. If any data point on the chart was unclear, the investigator (H.M.) interviewed the nurses and related surgeons. Three types of data were collected: (1) administrative data: hospital name, ward, surgeon; (2) patient characteristics: age, gender, allergy to beta-lactams; (3) antibiotic prophylaxis: agent, dose, initiation time, and total duration of administration.

Patients were excluded if they had or developed any of the following conditions during the course of admission: (1) receiving antibiotic therapy that was not prophylactic; (2) obvious postoperative
Chi-square test was applied. A p-value less than 0.05 was considered statistically significant.

Results

From April to September 2010, 365 patients from 63 surgical wards of eleven private hospitals were enrolled in our study.

The patient age range was 1—85, with a mean (standard deviation) of 36.9 (18.6). There were 196 (53.7%) men.

Table 1 shows the general characteristics of patients, their wound class, and the type of operation (emergency versus elective). Table 2 shows the wound class and the type of operation with regard to surgical specialty.

Prophylactic antibiotics were administered in 339 procedures. In 219 of these procedures, no antibiotics were recommended according to ASHP guidelines. The drug was therefore inappropriately given to 64.6% of patients. Twenty out of 26 patients did not receive appropriate antibiotic treatment.

Table 1. The general characteristics of patients, their wound class, and type of operation (emergency versus elective) in private and teaching hospitals.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Private hospitals</th>
<th>Teaching hospitals</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>365</td>
<td>1000</td>
<td>0.46</td>
</tr>
<tr>
<td>Gender: men/women</td>
<td>196/169</td>
<td>560/440</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>36.9</td>
<td>40</td>
<td>0.016</td>
</tr>
<tr>
<td>SD</td>
<td>18.6</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Wound class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean</td>
<td>211/</td>
<td>471</td>
<td>0.000</td>
</tr>
<tr>
<td>Clean-contaminated</td>
<td>154</td>
<td>426</td>
<td></td>
</tr>
<tr>
<td>Contaminated</td>
<td>0</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>Type of operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency/Elective</td>
<td>23/342</td>
<td>86/914</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Antibiotic choice

In cases that required antibiotic prophylaxis with respect to ASHP guidelines, antibiotic choice was concordant in 32 (25.4%) out of 126 procedures. When antibiotics were administered, the agents used most frequently were keflin (cefalotin) (51.5%), cefazoline (23%), ceftriaxone (7.7%) and gentamycin (3%). In 282 (77.3%), 135 (37%), and

Assessment of antibiotic prophylaxis

Adherence to five criteria was evaluated according to ASHP guidelines. (1) Did the surgical procedure justify the use of prophylactic antibiotics? If yes, the following items would be evaluated; otherwise, the case was considered as non-compliance. (2) Was the agent used selected appropriately? (3) Was the dose of the agent appropriate? (4) Was the agent started within 1 h prior to the procedure? (5) Was the agent used for longer than 24 h?

If more than one drug was prescribed for a single operation, all related parameters were considered separately for each agent. Only if all of the above criteria were fulfilled was the patient labeled as completely compliant.

Statistical analysis

Data were entered in SPSS 11.5 (SPSS Inc, Chicago, IL, USA), double-checked by an investigator, and analyzed. We used descriptive analysis including frequencies to evaluate the results. To compare our results with results from teaching hospitals [18], the

infection; (3) fever, any positive culture, or leukocytosis; and (4) receiving antibiotics for prophylaxis related to endocarditis. Otherwise, all patients were eligible for our study.

On the basis of $z = 1.96$, $d = 10\%$, $p = 10\%$, we included 350 surgical procedures (corresponding to 350 patients; one procedure per patient). On the day of data collection in each surgical ward at each private hospital, we selected six patients based on a random digital number table if the total number of existing patients was greater than six. Otherwise, we included all patients. Six patients from each ward were followed.
Table 2  Wound class and type of operation with regard to surgical specialty.

<table>
<thead>
<tr>
<th>Ward</th>
<th>Wound class</th>
<th>Operation type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clean</td>
<td>Clean-contaminated</td>
</tr>
<tr>
<td>Obstetric gynecology</td>
<td>43</td>
<td>17</td>
</tr>
<tr>
<td>General surgery</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>Urology</td>
<td>31</td>
<td>20</td>
</tr>
<tr>
<td>Orthopedic</td>
<td>29</td>
<td>19</td>
</tr>
<tr>
<td>ENT</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Plastic surgery</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Cardiac surgery</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>211</td>
<td>154</td>
</tr>
</tbody>
</table>

Table 3  Surgeons’ compliance with the American Society of Health-System Pharmacists guidelines on antibiotic prophylaxis in private hospitals as compared with teaching hospitals [18].

<table>
<thead>
<tr>
<th>Variables</th>
<th>Setting</th>
<th>χ²</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate use or non-use of antibiotics</td>
<td>Yes 140</td>
<td>910</td>
<td>417.46</td>
</tr>
<tr>
<td>No 225</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate agent used</td>
<td>Yes 32</td>
<td>54</td>
<td>59.35</td>
</tr>
<tr>
<td>No 88</td>
<td>854</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate initiation time</td>
<td>Yes 77</td>
<td>370</td>
<td>23.65</td>
</tr>
<tr>
<td>No 43</td>
<td>538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate duration</td>
<td>Yes 37</td>
<td>53</td>
<td>82.90</td>
</tr>
<tr>
<td>No 83</td>
<td>855</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total compliance</td>
<td>Yes 37</td>
<td>3</td>
<td>90.96</td>
</tr>
<tr>
<td>No 328</td>
<td>997</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19 (5.2%) cases, two, three, and four antibiotics were used, respectively. Only 83 patients (22.7%) received one type of antibiotic treatment.

Dose

In 32 procedures where proper antibiotic prophylaxis was administered, the recommended dosage was administered in 20 patients (62.5%), and a dosage lower than recommended was administered in 12 patients (37.5%).

Duration

Thirty-seven patients (29.4%) who needed prophylactic antibiotics received the appropriate duration of prophylaxis according to recommended guidelines. The duration of prophylaxis was shorter than recommended and longer than recommended in 9 (7.1%) and 80 (63.5%) patients, respectively. The median duration of antibiotic prophylaxis for the latter group was $2.86 \pm 1.6$ days.

Among 73 patients for whom a single-dose antibiotic was indicated, only 15 (20.5%) patients received single-dose antibiotic treatment.

Timing of antibiotic treatment was concordant with ASHP guidelines in 77 of 120 patients (61.1%). Timing of antibiotic administration was too early (more than 1 h before induction of anesthesia) in 9 patients (7.1%) and too late (more than 1 h after induction) in 34 patients (27%). Overall, 40 patients received intraoperative antibiotic readministration, which was concordant with guidelines in 17 patients due to prolonged operation duration (i.e., more than 4 h).

Discussion

This study demonstrates that the surgical teams in private hospitals in Shiraz, Iran have favorable
(95.23%) adherence to the recommended administration of prophylactic antibiotics when indicated. This value was significantly higher ($p < 0.001$) than the results obtained by a study in a teaching hospital [18] (91%). The willingness to use prophylactic antibiotics in our survey was higher than reports from Greece [17] (78.5%) and France [14] (83.3%). Only 8.3% of patients did not receive
appropriate antibiotic treatment. Although this rate is low, it is much higher than that obtained by teaching hospitals in Shiraz, Iran (2%) [18]. When antibiotic prophylaxis was indicated, 26.7% of patients received the appropriate agent; in our teaching hospitals, only 5.9% of patients received the proper agent (Table 3) [18]. Despite our low rate of selection of the correct agent, reports from developed countries reveal that at least fifty percent of patients were treated with antibiotic regimens that were compatible with the related guidelines [13,17,19].

Despite the considerable evidence showing no additional benefit of prolonged prophylaxis [7], surgeons in private hospitals in Shiraz extended the administration of antibiotics more than recommended by guidelines.

As shown in Table 3, the initiation time and duration of antibiotic administration were significantly higher in private hospitals compared to teaching hospitals [18]: 64.2% vs. 40.7% and 30.8% vs. 5.8%, respectively. Both values were lower than French [14], Greek [17], or Dutch [19] reports.

The overall compliance with guidelines in the surgical wards of private hospitals was significantly higher in private hospitals than in teaching hospitals (p < 0.001), which could be due to several factors [18]. First, private hospitals have no training surgical residents or fellows. Thus, they have fewer healthcare providers and less diversity in prescribing antibiotics [20]. Second, private-hospital surgical teams experience less member turnover, whereas the members of surgical teams in teaching hospitals change monthly according to their training program. Finally, private hospitals often prefer to admit less complicated patients [21], and people of higher socio-economic status usually prefer private hospitals.

Our study has several limitations. First, private hospitals in Shiraz constitute only about 10% of the private hospitals in Iran, so the results of our study could not be generalized to the private hospitals in Iran. Second, the cost-effectiveness and feasibility of ASHP guidelines in our region has not been documented. We chose ASHP as an available and international standard.

In conclusion, this prospective study revealed that in private hospitals in Shiraz, Iran, approximately 90% of patients received inappropriate surgical prophylaxis. Practical measures to improve the implementation of guidelines are urgently needed. Conducting a survey similar to the present study as a routine tool to control infection should be considered a viable approach to treatment.

Conflict of interest

Funding: This study was funded by the Vice-Chancellor for research at Shiraz University of Medical Sciences.

Competing interests: All authors disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, our work.

Ethical approval: Not required.

References


