Cost Evaluation of Corneal Ulcer Treatment

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Background: *Corneal ulcer is a common disease. To find the costs of corneal ulcer treatment would help plan the treatment strategy.*
Objective: *To evaluate the cost of treatment for corneal ulcers.*
Material and Method: *Age, gender, type of payment, causative organism, hospitalization days, and cost of treatment of hospitalized patients with clinically diagnosed corneal ulcer presenting between January 2011 and April 2012 was collected.*
Results: *Fifty-three patients were analyzed. The median cost (interquartile range) was 20,699.0 (11,379.0-56,981.0) Thai Baht. The median cost (interquartile range) for the fungal group, bacterial group, and unknown organisms was 70,040.0 (34,697.0-112,118), 17,881.5 (10,555.3-31,100.8), and 15,015.3 (9,542.3-46,866.6) Thai Baht respectively. Cost of treatment for fungal group was statistically significantly higher than for the unknown organisms and bacterial groups ($p<0.05$).*
Conclusion: *The expense of corneal ulcer treatment is high and fungal infection treatment tends to be the most expensive.*

Keywords: *Corneal ulcer, Cost*

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Corneal ulcer is a common disease. It is the important cause of impaired vision. Even though the infection is cured, the vision after treatment may not be perfect because the corneal scars that remain obscure vision[1-3]. Many patients must be admitted to hospital because they need close treatment and efficient eye drops. The length of admission depends on responsiveness to treatment. In some cases, a patient has to be admitted for months[2,4]. The expense of corneal ulcer treatment has two parts, the direct costs such as medicine and surgery, and the indirect costs such as the loss of income. A study from South India found that the expense of corneal ulcer treatment is higher than the patient's salary[5].

From the literature review, there is no report about the expense of the corneal ulcer treatment in Thailand. Thammasat Hospital is a tertiary care hospital that receives referred patients from other hospitals. Most of the referred patients have severe infections. The objective of the present study was to find the costs of corneal ulcer treatment in the inpatient department to help plan the treatment strategy.

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Material and Method

All clinically diagnosed with corneal ulcer who were admitted at Thammasat Hospital between January 2011 and April 2012 were included in this study. Data between January 1, 2011 and January 10, 2012 was retrospective and between January 11, 2012 and April 30, 2012 was prospective.

Age, sex, type of patient payment (government officer, social security, universal health coverage and self-paid), causative organism (result of smear, culture or pathology), and the length of admission were recorded. The expense of treatment such as medicine, surgery, medical service, laboratory, and room cost were collected from the financial department of the hospital. The present study was approved by the ethics committee of Thammasat University.

Statistical analysis, the treatment cost was analyzed by median and interquartile range. The comparison of expense between different organisms was analyzed by Kruskal-Wallis and Mann-Whitney U test at a 95% confidence interval.

Results

There were 53 cases in the present study. Thirty cases were male (56.6%) and 23 cases were female (43.4%). The mean age was 50.7±18.2 years. Range from 7 to 82 years. The causative organism was fungus in 15 cases (28.3%), bacteria in 14 cases

(26.4%), and unknown organism in 24 cases (45.3%).

The mean length of admission was 23.3±19.9 days (range 2-76 days). Fungal infection had the longest admission (37.5±24.5 days) followed by unknown organism (18.7±17.1 days), and bacterial infection (16.1±9.6 days).

The type of payment were 32 universal health coverage cases (60.4%), eight social security cases (15.1%), eight self-paid cases (15.1%), and five government officer cases (9.4%). The median cost (interquartile range) was 20,699.0 (11,379.0-56,981.0) Thai Baht. The most expensive was for fungal infection (70,040.0 [34,697.0-112,118] Thai Baht), followed by bacterial infection (17,881.5 [10,555.3-31,100.8] Thai Baht). The unknown organism was the lowest cost (15,015.3 [9,542.3-46,866.6] Thai Baht). The details of treatment expenses are shown in Table 1. The fungal infection group had different expenses from the bacterial and unknown infection groups (except in laboratory costs) significantly ($p<0.05$) (Table 1, 2).

Table 1. Comparison of costs for corneal ulcer treatment (Thai Baht) across organisms with Kruskal-Wallis test

Cost	Median (Interquartile range)				p-value
	Bacteria (n = 14)	Fungus (n = 15)	Unknown (n = 24)	Total (n = 53)	
Drug	2,106.5 (950.3-5,000.5)	21,717.0 (9,047.0-30,438.0)	2,246.0 (1,053.5-7,757.1)	3,712.0 (1,257.8-12,369.0)	0.001
Surgery	0.0 (0.0-0.0)	12,300.0 (0.0-29,750.0)	0.0 (0.0-3,875.0)	0.0 (0.0-8,825.0)	<0.001
Service	5,100.0 (2,950.0-9,775.0)	15,600.0 (4,400.0-22,800.0)	3,150.0 (2,400.0-9,675.0)	4,800.0 (2,525.0-12,850.0)	0.032
Laboratory	3,855.0 (3,083.8-6,683.8)	7,330.0 (3,335.0-9,520.0)	3,690.0 (2,480.0-6,497.5)	4,080.0 (2,992.5-7,435.0)	0.118
Room	4,950.0 (2,550.0-8,325.0)	14,400.0 (7,600.0-18,200.0)	3,900.0 (2,475.0-10,800.0)	7,400.0 (2,700.0-12,750.0)	0.008
Total	17,881.5 (10,555.3-31,100.8)	70,040.0 (34,697.0-112,118.0)	15,015.3 (9,542.3-46,866.6)	20,699.0 (11,379.0-56,981.0)	0.001

Discussion

Most of the corneal ulcer patients were male and of working age. The most common pathogens were bacteria and fungus[6-14]. In the present study, patients and causative organisms were the same as other reports that had been studied before.

The treatment expenses that patients had to pay directly, while being admitted to hospital were medicine, surgery, medical services, laboratory, and room expenses. The median expense for corneal ulcer treatment is 20,699.0 Thai Baht, which is a high expense. From April 1, 2012, the lowest wage in Thailand is 300 Thai Baht per day. A patient who has the lowest wage has to work for 69 days to pay for treatment. At the same time, no salary is earned while a patient is in a hospital. The average hospital admission days was 23.3 days. The longest admission was 76 days. If calculated from the lowest wage, a patient lost 6,966 Thai Baht on average admission days and the maximum would be 22,800 Thai Baht for the longest admission days. This does not include other indirect expenses, for example the lack of income from relatives who have to take care of the patient and transportation expenses.

In Thailand, there is universal health coverage, social security, government officer funds that can be claimed for health services. From the present study, only 15.1% of patients had to pay by themselves. The rest could claim from the above funds. The money that

Table 2. Comparison of treatment costs (Thai Baht) between organisms with Mann-Whitney U test

Cost	p-value		
	Bacteria-fungus	Bacteria-unknown	Fungus-unknown
Drug	0.002	0.785	<0.001
Surgery	0.001	0.273	0.001
Service	0.055	0.232	0.020
Laboratory	0.176	0.650	0.040
Room	0.003	0.832	0.012
Total	0.003	0.976	0.001

is paid for treatment comes from tax. The government has to pay for this health expense instead of paying for other public development.

When comparing foreign reports in cases of monetary value, it is difficult to compare because of the differences in the cost of living. However, it tends to be that fungal infection treatment has the highest cost. Prajna studied in south India[5] found that fungal infection treatment was the highest cost (90.8±7.1 US Dollars). If the exchange rate was 31 Thai Baht/1 US Dollar, it was 2,814.8±220.1 Thai Baht. For unknown and bacterial infection was 89.4±9.5 US Dollars (2,771.4±294.5 Thai Baht) and 69.5±6.4 US Dollars (2,154.5±198.4 Thai Baht) respectively. Keay studied in Australia[15] found the same conclusion that the expense of fungal infection treatment was higher than bacterial infection treatment. Fungal infection treatment was 4,648 AU Dollars or 148,736 Thai Baht (exchange rate was 32 Thai Baht/1 AU Dollar). Gram negative bacterial infection treatment was 1,779 AU Dollars (56,928 Thai Baht). Gram-positive bacterial infection treatment was 1,191 AU Dollars (38,112 Thai Baht). The present study found similar conclusions as Keay and Prajna's Studies. The highest cost of treatment was for fungal infection (median cost [interquartile range] 70,040.0 [34,697.0-112,118] Thai Baht) followed by bacterial infection (17,881.5 [10,555.3-31,100.8] Thai Baht) and the lowest expense was for unknown organism infection (15,015.3 [9,542.3-46,866.6] Thai Baht). Fungal infection treatment is more expensive than bacterial and unknown infection treatment because antifungal drugs are more expensive and a patient has to be admitted for a longer time as well as requiring surgical intervention more often than for other infections.

The differences in expenses for corneal ulcer treatment depend on many factors. The most important factor is the type of pathogens, because different pathogens can respond to different antibiotics. The hospital potential is another factor. A tertiary care hospital that gets referred patients from other hospitals has a chance to offer more expensive treatment than primary care hospitals because referral cases tend to be more severe cases, be drug resistant, and requiring surgical intervention cases[5].

The expenses shown in the present study do not represent all the expenses of corneal ulcer treatment in Thailand. Some parts of the expenses might not be covered. For example, the expense after a patient is discharged from hospital and requiring follow-up in an outpatient department was excluded. However, some part of the expenses may be over budget because Thammasat Hospital is a tertiary care hospital so most of the patients tend to be severe cases.

Conclusion

The expense of corneal ulcer treatment is high and fungal infection treatment tends to be the most expensive.

Potential conflicts of interest

None.

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การประเมินผลค่าใช้จ่ายในการรักษาแผลกระจกตาติดเชื้อ

โกศล คำพิทักษ์, สุรีพร ภัทรสุวรรณ, กิตติพงษ์ คงสมบูรณ์

ภูมิหลัง: *โรคแผลกระจกตาเป็นโรคที่พบได้บ่อย การทราบค่ารักษาจะทำให้ช่วยการวางแผนในการบริหารต่อไปในอนาคต*
วัตถุประสงค์: *เพื่อศึกษาค่าใช้จ่ายในการรักษาโรคแผลกระจกตาติดเชื้อ*
วัสดุและวิธีการ: *ผู้ป่วยที่ได้รับการวินิจฉัยว่าเป็นแผลกระจกตาติดเชื้อที่รับตัวไว้นอนรักษาในโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ ช่วงเวลาระหว่าง 1 มกราคม พ.ศ. 2554 ถึง 30 เมษายน พ.ศ. 2555 โดยบันทึกข้อมูล อายุ เพศ สิทธิการรักษา ผลการตรวจหาเชื้อ จำนวนวันที่นอนพักรักษาตัวในโรงพยาบาล ค่าใช้จ่ายที่เกิดจากการรักษา*
ผลการศึกษา: *มีผู้ป่วยทั้งหมด 53 ราย ในช่วงระยะเวลาดังกล่าว ค่ามัธยฐานค่ารักษาทั้งหมด 20,699.0 (11,379.0-56,981.0) บาท ค่ามัธยฐานค่ารักษาในกลุ่มติดเชื้อรา เชื้อแบคทีเรีย และไม่ทราบเชื้อ เท่ากับ 70,040.0 (34,697.0-112,118) บาท, 17,881.5 (10,555.3-31,100.8) บาท และ 15,015.3 (9,542.3-46,866.6) บาท ตามลำดับ ค่ารักษาแผลกระจกตาติดเชื้อจากเชื้อรามีค่าใช้จ่ายสูงกว่ากลุ่มที่ไม่ทราบเชื้อและแบคทีเรียอย่างมีนัยสำคัญ ($p<0.05$)*
สรุป: *การรักษาแผลกระจกตาติดเชื้อมีค่าใช้จ่ายที่สูง ค่ารักษาของแผลกระจกตาที่เกิดจากเชื้อราจะมีค่าใช้จ่ายสูงที่สุด*