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COST-EFFECTIVENESS DEXKETOPROFEN VS KETOROLAC IN CAESAREAN PATIENTS AT 'X' HOSPITAL, PANDEGLANG

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ABSTRACT

Post-cesarean section pain must be treated promptly and appropriately to prevent chronic conditions. Dexketoprofen and Ketorolac are non-narcotic analgesics commonly used to manage such pain. This study aimed to analyse the cost-effectiveness of dexketoprofen and ketorolac in patients undergoing cesarean sections at Mother and Child Hospital "X" in Pandeglang. The study used a cross-sectional design with cost-effectiveness analysis, specifically the Average Cost-Effectiveness Ratio (ACER). Pain intensity was measured one hour after surgery using the Faces Pain Rating Scale and Visual Analog Scale (VAS). Inclusion criteria were patients who underwent cesarean section and received non-narcotic analgesics. A total of 90 patients participated: 39 in the dexketoprofen group and 51 in the ketorolac group. Data were analyzed using ACER and the Mann-Whitney test. The ACER, based on the Faces Pain Rating Scale, showed a cost of IDR 1,142 for the dexketoprofen group and IDR 958.03 for the ketorolac group. Using the VAS, the cost was IDR 1,110 for dexketoprofen and IDR 657.45 for ketorolac. Statistical results showed a p-value < 0.05 for both pain measurement tools, indicating a significant difference in effectiveness between the two therapies. Based on both instruments, ketorolac was more cost-effective than dexketoprofen in managing post-cesarean section pain. This finding suggests that ketorolac may be a preferable option in clinical settings where cost and effectiveness are key considerations for post-operative analgesia in cesarean section patients.

Keywords: *cost-effectiveness analysis, dexketoprofen, ketorolac, sectio caesarea,*

INTRODUCTION

The caesarean section (CS) birth rate continues to increase and exceeds the average value recommended by WHO. According to WHO, the standard caesarean section rate is 5-15 percent per 1,000 births. Based on WHO Global on Maternal and Perinatal Health data, 46.1% of all births are caesarean sections. The highest number of caesarean section deliveries occurred in Latin America and the Caribbean (40.6%), followed by Europe (25.1%), Asia (19.3%), and Africa (7.4%). Based on the results of the 2018 Basic Health Research (RISKESDAS),

the incidence of caesarean section deliveries in Indonesia was 17.6%. This figure is highest in the DKI Jakarta area at 31.3%, while the lowest figure was found in Papua at 6.7%. Meanwhile, Banten has a percentage of 19.3% (Kementerian Kesehatan RI, 2018).

An essential aspect of post-caesarean section therapy is the use of analgesic drugs to relieve pain without causing loss of consciousness. There are two groups of analgesic medications, namely narcotic and non-narcotic analgesics. The choice of drug depends on the individual's pain level. Non Steroid Anti-Inflammatory Drug (NSAID) is a group of non-narcotic analgesics that are often used (Mita & Husni, 2017). NSAID therapy used in post-cesarean section pain management, such as dexketoprofen and ketorolac, has similar pain-relieving effects (Febriana et al., 2021).

Clinical studies support the use of injectable dexketoprofen as a post-cesarean analgesic. A randomised clinical trial showed that dexketoprofen trometamol 50 mg IV given immediately after cesarean delivery, compared with lornoxicam 8 mg IV or placebo, was effective in reducing postoperative pain and opioid requirements. A standard dosing protocol is a 50 mg injection every 8 hours, administered slowly (IV) over 15 minutes, and in combination with paracetamol, is often used in a multimodal manner (Aykaç et al., 2012). Meanwhile, the use of ketorolac injection is also widely used in post-cesarean analgesia. The results of a randomised controlled study in the United States (Tufts University) found that routine administration of 30mg IV ketorolac every 6 hours, starting with two doses immediately after surgery and continuing with four subsequent doses, significantly reduced opioid consumption in the first 72 hours post-surgery compared to placebo (Hostage et al., 2023). Another study confirmed that a dose of 30mg every 6 hours for the first 24 hours was effective in controlling acute pain while having a good safety profile, with most guidelines emphasising limited use to 24 hours to reduce risks to breastfeeding (McNicol et al., 2021). Thus, in Indonesia or based on global literature which is also adopted in local practice, dexketoprofen injection 50mg IV every 8 hours, and ketorolac injection 30mg IV/IM every 6 hours are standard regimens after cesarean section, of course still in short duration (≤2 days for dexketoprofen and ≤24–36 hours for ketorolac) and should be used within the framework of multimodal analgesia.

Evaluation of therapy can be done by measuring pain intensity using validated and reliable measuring tools, such as the Faces Pain Rating Scale and VAS (Andreyani &

Bhakti, 2023; Arsyawina et al., 2014; Mariyam & Widodo, 2012).

Cost Effectiveness Analysis (CEA) is a pharmacoeconomic method used to determine and evaluate the best program or drug from several therapeutic options that have the same goal. This method involves calculating the ACER and the ICER to identify the more cost-effective treatment between two treatment alternatives being considered (Kementrian Kesehatan RI, 2013).

This study aims to evaluate the ACER and ICER of cesarean section pain management using dexketoprofen and ketorolac injections at the 'X' Pandeglang Mother and Child Hospital, and to determine which therapy is more cost-effective.

METHODS

1. Research design

This study employs a cross-sectional design with a descriptive approach and collects data through primary data collection, which involves providing questionnaires to patients, and secondary data in the form of drug use cost data. Data analysis for the pain scale was conducted using the SPSS 22 for Windows program for the Mann-Whitney test with a 95% confidence interval. The calculation of cost-effectiveness employed the CEA method. The research instruments used were the Faces Pain Rating Scale and the Visual Analogue Scale (VAS) pain.

2. Population and sample

The population of this study was inpatient pregnant women who had undergone a cesarean section procedure using non-narcotic analgesics at the “X” Maternity and Children's Hospital in the period January 1- March 30, 2024. The sample in this study consisted of questionnaire data and medical cost data from inpatient pregnant women who were scheduled to undergo a cesarean section procedure, using a purposive sampling technique according to the research criteria. The minimum sample size is calculated using the Slovin formula because the total population is known. The population in this study consisted of 97 individuals. After the Slovin calculation, the minimum sample size was determined to be 78 samples.

The inclusion criteria in this study included patients who gave birth by cesarean section and used non-narcotic analgesics post-CS, ketoprofen injection or dexketoprofen injection at the “X” Pandeglang Mother and Child Hospital. Meanwhile, the exclusion criteria included patients who did not give birth by cesarean section and patients who went home with At Own Request status.

3. Data analysis

This study employed both qualitative and quantitative methods for data analysis. Quantitative analysis was conducted by classifying patient characteristics based on age, education, history of cesarean section, and therapy used. Additionally, quantitative analysis involved calculating the ACER value. Data collection was conducted using the Microsoft Excel program, while data analysis was performed using SPSS 22 for Windows for the Mann-Whitney test with a 95% confidence interval.

4. Ethical approval

This study has received ethical approval from the Health Research Ethics Committee of Bakti Tunas Husada University, Tasikmalaya, with letter number 185-02/E.01/KEPK-BTH/VI/2024. All procedures were conducted by the principles of research ethics, and respondent participation was voluntary, obtained with informed consent.

RESULTS AND DISCUSSION

The results of the study on 90 respondents of post-section caesarean patients after receiving analgesics dexketoprofen and ketorolac analgesics at the Mother and Child Hospital "X" Pandeglang will be presented in the following table, which describes in detail the distribution of respondent characteristics based on age, education, history of caesarean section, and use of analgesic injection drugs in the postpartum ward of the Mother and Child Hospital "X" Pandeglang as follows. Table 1 presents the highest results among early adult respondents (21-27 years), with 47 patients (52.2%) affected. Reproduction is considered ideal in the age range of 20-35 years, as this is the time when a woman's physical condition is at its most productive. The uterus is ready to provide optimal protection for pregnancy, and mentally, women are more mature to maintain and care for pregnancy (Bayrampour et al., 2012). On the other hand, women over the age of 35 have a lower chance of getting pregnant, with a higher risk of congenital abnormalities, complications during childbirth, and maternal death (Glick et al., 2021). This risk can even be three times higher than for women in the healthy reproductive age range, namely between 20 and 34 years (Prawirohardjo, 2008).

The results of post-section caesarean respondents at the Mother and Child Hospital "X" Pandeglang showed that the highest results were found in respondents with a senior high school education level, with 38 patients (42.2%) affected. The level of education affects a person's response to external stimuli. People with higher education tend to give more logical responses

than those with middle or lower education (Marginson et al., 2023). Education also plays a role in shaping the perception of pain, especially in the modulation process, namely the interaction between the endogenous analgesic system and pain signals that enter the posterior horn of the spinal cord (Yam et al., 2018). This modulation process makes pain perception subjective because the meaning or interpretation of the pain signal determines it (Bramita et al., 2024).

Table 1. Characteristics of post-sectio caesarea patients

Characteristics	N = 90 Frequency (n)	Percentage (%)
Age		
21-27 Years	47	52.2
28-34 Years	35	38.9
35-42 Years	8	8.9
Education Background		
Elementary school	8	8.9
Junior High School	15	16.7
Senior High School	38	42.2
Diploma/Bachelor	29	32.2
History of Caesarean Section		
First History	50	55.6
Second History	32	35.6
Third History	8	8.9
Therapies used		
Dexketoprofen	39	43.3
Ketorolac	51	56.7

According to Potter and Perry (2022), a person's level of education is not a factor that influences pain. However, in reality, the higher a person's education, the more positive their behaviour tends to be, because the education obtained can increase an individual's understanding (Yiwa, 2022).

Based on Table 1, the majority of respondents were patients who did not have a history of cesarean section delivery, with 50 patients (55.6%), which is greater than the number of mothers who have a history of cesarean section. Patients who undergo cesarean section for the first time tend to experience more intense pain than patients who have previously undergone cesarean section, so they are more tolerant of pain (Agustari et al., 2022; Sugianti, 2020).

According to research conducted by Octasari and Inawati (2021), at St. Elisabeth Hospital Semarang, ketorolac injection therapy has been proven effective in reducing the pain scale felt by caesarean section patients for up to 1-4 hours after surgery (Octasari & Inawati, 2021).

The measurement of effectiveness in this study was based on the results of the pain scale, as measured by the Faces Pain Rating Scale and VAS questionnaires. The effectiveness of therapy was analyzed by comparing the results of the two instruments. The Faces Pain Rating Scale, with a value of

0-3, indicates that the therapy group is effective. While the Visual Analogue Scale with a value of 70-100 indicates that the therapy is also effective.

Research by Ginong et al. (2020) demonstrates that the Faces Pain Rating Scale considers the functional value between interval levels, which provides meaning to the comparison of expressions and the scale of pain experienced. Interpretation of the patient's pain scale is carried out by comparing research instruments, namely VAS, NRS, and FPRS, which have good accuracy in measuring pain levels in patients (Pratitdya et al., 2020).

Table 2. Pain assessment instrument faces pain rating scale

Group	Faces Pain Rating Scale						p-value
	Total	%	< 3 FPRS Value	%	>3 FPRS Value	%	
Dexketoprofen	39	100	34	87.2	5	12.8	<0.001
Ketorolac	51	100	28	54.9	23	45.1	

Table 2 shows the description of the pain response of post-cesarean section patients after administration of analgesics, dexketoprofen and ketorolac, with the Faces Pain Rating Scale instrument in the postpartum inpatient room of the "X" Pandeglang Mother and Child Hospital. The Dexketoprofen group showed higher effectiveness than the ketorolac group. In the non-parametric Mann-Whitney test analysis, a significance value of <0.001 (< 0.05) was obtained, indicating a significant difference in the Faces Pain Rating Scale between the two treatment groups.

The use of the VAS instrument is widely used in Indonesia to measure the pain scale during surgery, compared to other instruments such as the Numeric Rating Scale (NRS) (Paluwih et al., 2019). The results of pain scale measurements using VAS are shown in Figure 3.

Dexketoprofen is considered superior to ketorolac because it has a faster onset of action, a better gastrointestinal safety profile, and equivalent analgesic effects at lower doses. Several studies have shown that dexketoprofen provides more effective pain control in a shorter period and reduces the need for additional opioids postoperatively. A study conducted by Hana et al. (2019) stated that dexketoprofen has high analgesic efficacy with good tolerability in acute pain (Hanna & Moon, 2019). In addition, research by Patrocinio et al. (2007) showed that

dexketoprofen 50 mg intravenously has equivalent or better efficacy than other NSAIDs, with an onset of action of around 30 minutes (Patrocínio et al., 2007). This pharmacokinetic advantage is a valuable added benefit, particularly in post-cesarean section pain management.

Table 3. Visual analog scale instrument pain assessment

Group	Visual Analog Scale						p-value
	Total	%	VAS Value>70	%	VAS Value<70	%	
Dexketoprofen	39	100	35	89.7	4	10.3	0.002
Ketorolac	51	100	41	80.4	10	19.6	

Table 3 describes the pain response of post-cesarean section patients after administration of dexketoprofen and ketorolac analgesics using the VAS instrument in the postpartum room of the "X" Pandeglang Mother and Child Hospital. The Dexketoprofen group showed higher effectiveness than the ketorolac group. In the Mann-Whitney non-parametric test analysis, a significance value of 0.002 was obtained, so it can be concluded that there is a significant difference in the pain scale using the VAS instrument between the two treatment groups.

The severity of pain is also influenced by the patient's physiological and psychological conditions. Psychological factors before CS surgery, such as preoperative stress, contribute significantly to the severity of postoperative pain and fatigue felt one week after surgery. The pain felt varies according to the intensity and severity of each individual (Montgomery et al., 2010).

The results of this study align with the theory proposed by Ceyhan et al. (2016), which suggests that NSAID agents, particularly dexketoprofen, can provide more effective pain relief after cesarean section. Dexketoprofen shows high effectiveness in reducing pain to severe pain levels, both as a single dose and in combination (Ceyhan et al., 2016). Ketorolac can reduce the scale of post-operative pain from mild to moderate pain. Ketorolac functions to inhibit prostaglandin synthesis, which acts as a mediator in inflammation, pain, fever, and as the primary pain reliever (Octasari & Inawati, 2021).

In this study, each analgesic was given in a single dose. The general analysis showed that the analgesics dexketoprofen and ketorolac gave an excellent effect on caesarean section surgery by reducing the

intensity of pain. The results of this study are supported by the theory, as outlined by Hamilton (1995), which states that pharmacological treatment is often used to reduce post-caesarean section pain. Pharmacological pain control is effective for moderate to severe pain. However, the administration of pharmacology does not aim to improve the patient's ability to control pain, so a combination of pharmacology and non-pharmacology is needed to reduce pain and accelerate the recovery period without continuing (Hamilton, 1995).

Cost-effectiveness analysis is an evaluation conducted to measure cost efficiency from a hospital perspective. This measurement is based on the ACER formula as the primary criterion. The ACER calculation is obtained by dividing the total direct medical costs for each type of drug by its effectiveness. The lower the ACER value, the higher the level of cost-effectiveness of a therapy.

Table 4. Total patient cost calculation

Group	Number of Patients	Cost of treatment (IDR)	Total Number of All Patients	Total Medical Cost per Patient (IDR)
Dexketoprofen	39	IDR 33,189	IDR 3,883,113	IDR 99,567
Ketorolac	51	IDR 17,532	IDR 2,682,396	IDR 52,596

Based on Table 4, the cost of treatment for patients with cesarean section in the dexketoprofen therapy group is IDR 33,189, with a total cost of IDR 3,883,113. Meanwhile, patients using the ketorolac therapy group have a cost of IDR 17,532 with a total cost of IDR 2,682,396. In terms of drug costs, there are doses with varying prices, where each cesarean section patient is given therapy 3 times within 1x24 hours after the cesarean section procedure.

Table 5. Cost effectiveness analysis (Faces Pain Rating Scale)

Group	Total cost	Effectiveness	ACER (Total Cost/Effectiveness)
Dexketoprofen	IDR 99,567	87.2%	IDR 1,142
Ketorolac	IDR 52,596	54.9%	IDR 958,03

In Table 5, it can be seen that the ACER value based on the assessment using the Faces Pain Rating Scale, the ketorolac injection therapy group has a value of IDR 958.03 with an effectiveness of 54.9%. This value is significantly lower than that of the dexketoprofen injection group. The dexketoprofen injection group has an ACER

value of IDR 1,142 with an effectiveness of 87.2%.

Table 6. Cost effectiveness analysis (Visual Analog Scale)

Group	Total cost (IDR)	Effectiveness	ACER (IDR)
Dexketoprofen	IDR 99,567	89.7%	IDR 1,110
Ketorolac	IDR 52,596	80.4%	IDR 654

In Table 6, it can be seen that the ACER value based on the assessment using the Visual Analogue Scale indicates that ketorolac injection therapy has a lower value than dexketoprofen therapy in terms of each component and total cost. Dexketoprofen therapy results in a higher total cost, but with higher effectiveness, while ketorolac therapy has a lower total cost with effectiveness that is not significantly different from dexketoprofen. The ACER value in the dexketoprofen therapy group is IDR 1,110, while in the ketorolac therapy group it is IDR 654.

The most cost-effective intervention is the intervention with the lowest ACER calculation result compared to other interventions. The lower the ACER value, the more efficient the costs incurred to achieve the desired results (Kementrian Kesehatan RI, 2013). Based on the research results presented in Tables 5 and 6, the ketorolac group is more cost-effective than the dexketoprofen group.

Although dexketoprofen showed slightly better clinical efficacy, ketorolac was considered more cost-effective because it had a much lower unit drug price. In pharmacoeconomic analysis, therapies with relatively equal efficacy but significant cost differences can make the lower-cost option a more efficient choice. Therefore, although dexketoprofen was superior in some clinical parameters, ketorolac provided a greater benefit-to-cost ratio, making it more cost-effective.

This study is in line with research conducted by Nurfita et al. (2018), which showed that caesarean section patients who used the ketorolac therapy group were more cost-effective compared to patients who were given dexketoprofen therapy (Nurfita et al., 2018). The results of the ACER calculation in this study can be presented in a cost-effectiveness quadrant diagram as shown in Figure 1.

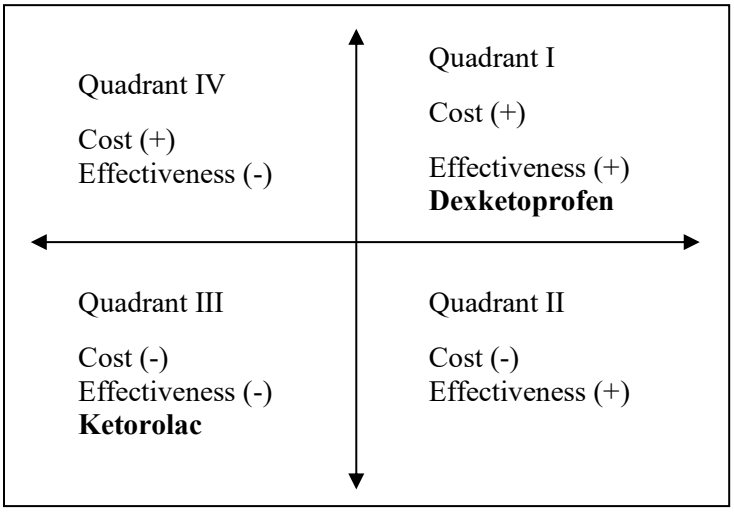

Figure 1. Cost effectiveness quadrant

In Figure 1, it can be seen that the dexketoprofen therapy group had a higher average total cost, but with higher effectiveness (quadrant I). In comparison, the ketorolac therapy group had a lower average total cost, but with lower effectiveness (quadrant III). Based on the results of the cost-effectiveness quadrant, further consideration is needed with the ICER calculation (Kementrian Kesehatan RI, 2013).

Table 7. ICER calculation results

Instrument	Intervention	ΔCost (IDR)	ΔEffectiveness	ICER Value (ΔCost/ΔEffectiveness)
Faces pain rating scale	Dexketoprofen – Ketorolac	IDR 46,971	32.2%	IDR 1,454
Visual analog scale	Dexketoprofen – Ketorolac	IDR 46,971	9.3%	IDR 5,050

ICER calculation is needed to determine the additional costs required to achieve the highest level of effectiveness in caesarean section patients. Based on the results of Table 7, to increase the effectiveness of the ketorolac therapy group compared to the dexketoprofen group, an additional cost of IDR 1,454 is required for the Faces Pain Rating Scale instrument and IDR 5,050 for the VAS instrument. The costs calculated through ACER and ICER show the need for additional costs for every 1% increase in effectiveness.

The limitations of this study include its limited scope within a single hospital and the exclusion of other clinical factors, such as a

history of CS, comorbidities, and drug interactions, which may impact the effectiveness of therapy. In addition, this study only evaluated the direct cost aspect from the hospital's perspective. Suggestions for further research include conducting studies in a broader and more diverse population, involving multiple health facilities, and incorporating indirect and long-term cost analysis to ensure that the results obtained are more comprehensive and can be applied to broader health policies.

CONCLUSIONS

The ACER value obtained from this study with the Faces Pain Rating Scale instrument was IDR 1,142 for dexketoprofen injection and IDR 958,03 for ketorolac injection. The calculation results based on the VAS instrument showed an ACER value of IDR 1,110 for dexketoprofen injection and IDR 654,17 for ketorolac injection. The ICER calculation results showed that to increase the effectiveness of the ketorolac therapy group compared to the dexketoprofen therapy group, an additional cost of IDR 1,454 was required based on the Faces Pain Rating Scale instrument assessment, and IDR 5,050 based on the Vas instrument assessment.

In this study, both dexketoprofen and ketorolac demonstrated comparable efficacy in reducing postoperative pain in caesarean section patients. The mean pain scores (VAS) at 1,6 and 12 hours post-administration showed no statistically significant difference between the two groups ($p > 0.05$), indicating that both drugs are clinically effective for postoperative analgesia. Therefore, the cost-effectiveness comparison becomes the key differentiating factor in recommending the optimal analgesic agent.

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