

**Original Article Template**

# **Characteristics of Pain Based on Numerical Rating Scale in Maxillofacial Trauma Patients Treated with Open Reduction Internal Fixation**

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**ABSTRACT**

**Introduction:** Open Reduction Internal Fixation (ORIF) is one of the maxillofacial bone fracture treatment procedures. Post-surgical pain is generally assessed by Numerical Rating Scale (NRS). **Objective:** To obtain information about pain characteristics in post-ORIF patients based on NRS. **Methods:** This study is an observational study with a retrospective descriptive approach. The research was conducted at Hasan Sadikin General Hospital (RSHS) Bandung in January 2018 - December 2019 based on medical record data. The data collected included age, gender, fracture area, diagnosis, duration of surgery, number of plates and screws, pre-surgical and post-surgical pain based on NRS, pain intensity measured every 8 hours postoperatively for 24 hours. **Results:** In this study, 65 medical records were obtained. The most frequent characteristics of the subjects were young adults aged 17-30 years (56.92%) and males (86.15%). The most frequent fracture locations were the mandible area (48.67%) and the most frequently performed surgery was at the mandibular area (60.46%). Regarding the duration of the surgery, most of the surgeries lasted for 61-120 minutes (32.30%) with the most used plates were plates (1-10 holes) and plates (11-20) holes, both having the same percentage (38.46%), and the most frequently used screw

was screw (1-10) (49.23%). The most frequently used analgesics was Ketorolac (87.69%) and The NRS pain scale for ORIF was a mild type of surgery with an NRS scale of 1-3. The mean of pre-ORIF surgery patients showed a mild pain intensity with a percentage of 92.30% and postoperatively resulted in mild pain with a percentage of 95.38%. **Conclusion:** Characteristics of pain based on NRS in maxillofacial trauma patients treated with ORIF indicate mild pain and could be the result of the influence of analgesic drugs or subjective assessments, therefore, further research is needed to obtain a more precise assessment of the pain.

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## 1. INTRODUCTION

Pain is a subjective and unpleasant sensory and emotional state that relates to actual or potential tissue damage or describes the condition in which the damage occurs.<sup>1</sup> Pain is one of the most common complaints that patients experience in the hospital. According to Walters, most patients complained about headaches, which was 40%, followed by back pain with 39%, and neck pain with 31%. About 66% of patients with headaches experienced this condition for more than three months and 11% of the cases were affecting the daily activities, while back and neck pain (81%) lasted more than three months and had an impact of 32% on daily activities.<sup>1,2</sup>

Briggs and Closs highlighted that pain is also influenced by many intrinsic and extrinsic factors and that many aspects of pain are assessed in different ways. According to Hird, pain is the result of sensory stimulation and psychological factors such as a person's personality and anxiety level. Although no one defined pain the same way, the intensity of pain, depending on the patient's perception, should be assessed in terms of effective pain management. Pain perception depends on each person's pain threshold, which may be used as a basis for comparing pain intensity. Assessment of pain intensity and placement is a routine procedure in clinical practice.<sup>2,3</sup>

Pain sensations are classified into nociceptive pain, neuropathic pain, and a combination of both. Nociceptive pain caused by activation of nociceptors results from actual damage to non-neural tissue. Neuropathic pain is developed by impaired function and/or pathological changes in the nervous system.<sup>4,5</sup>

Accuracy of pain assessment is essential to evaluate proper treatment. Pain intensity is the initial factor that indicates sensation and function. Therefore, pain measurement tools are used to help assess pain intensity and effectively monitor its response to treatment decisions. Generally, pain is conceptualized as a nociceptive process that describes the transduction, transmission, and processing of the spinal cord from nociceptive signals associated with acute and chronic pain.<sup>2,5,6</sup>

Regardless of whether it is acute or chronic, pain assessment should be simple and practical, because the intensity of pain is considered as one of the main factors that determine its effect on a human's feelings and function as a whole being. There are several scales to rate the pain. The multidimensional pain scale assesses associated

factors, location/severity, chronicity, quality, contribution/distribution, pain etiology (if identifiable), mechanism of injury, a hindrance to pain assessment, and can provide an overview of pain measurements commonly used in the field of Oral and Maxillofacial Surgery.<sup>2,7</sup>

McGill Pain Questionnaire and the Wisconsin Brief Pain Questionnaire are suitable for assessing chronic pain, while unidimensional scales such as Visual Analogue Scales (VAS), Verbal descriptor scale, Verbal rating scale, Numerical Rating Scale (NRS), Faces Pain Scale, Wong-Baker Faces Pain Rating Scale (WBS), and Full Cup Test is utilized to evaluate acute pain.<sup>2</sup> The WBS is widely used to assess pain in children and the elderly because other scales are often difficult to understand, which as a result can lead to a pain intensity that is too high. In dental or Oral and Maxillofacial Surgery research, the use of VAS is more common because it is more reliable, valid, sensitive, and appropriate. However, for assessment of the postoperative period, the use of NRS, which is a development of VAS, is considered more effective and the reliability of NRS has been tested by Brunelli, et al. on postoperative patients.<sup>2,8,9</sup>

Maxillofacial trauma is a case that is experienced by many patients in the Emergency Unit of various hospitals in the world. Maxillofacial fractures can occur due to various etiologies, including traffic accidents especially motorbikes, physical attacks, sports, and falls from a high place. Based on some of the causes above, traffic accidents are the most common cause of maxillofacial fractures.<sup>6</sup> One of the treatments for patients with maxillofacial fractures is the Open Reduction Internal Fixation (ORIF), which aims to fix and immobilize the fracture area in the patient to obtain good healing.<sup>10</sup> The purpose of ORIF surgery is to reduce pain, restore bone function, and prevent further injury.<sup>11</sup> The fixation device used consists of several screws that penetrate the bone and are connected by a plate so that the reduced bone is clamped by the plate and screw. Complications of ORIF may result in things like pain, swelling, or difficulty in moving, nerve damage, and imperfect bone healing.<sup>11</sup> Based on research conducted by Forouzanfar in 2013, both intermaxillary fixation (IMF) and ORIF treatment have complications, such as chin deviation and facial asymmetry, reduced mandibular mobility, dysfunction of the Temporomandibular Joint (TMJ), ankylosis, malocclusion, and chronic pain.<sup>13</sup> Post-ORIF pain is caused by invasive surgery. Even though the bone fragment has been reduced, manipulation such as screwing and placement of the plate through the bone will cause severe pain. The pain is acute and lasts for hours to days.<sup>13,14</sup> This is due to the ongoing inflammatory phase accompanied by tissue edema. The duration of the healing process after receiving treatment with internal fixation will result in limitation of movement caused by pain and adaptation to the addition of the screw and plate. This painful condition often causes disturbances within patients, both physiological and psychological.<sup>11,14</sup> We designed this study to obtaining information about the characteristics of pain in maxillofacial trauma patients who have undergone ORIF treatment based on NRS. These studies are expected to enrich scientific knowledge and to be able to trigger other researches, particularly those related to maxillofacial pain after ORIF treatment.

## 2. MATERIAL AND METHODS

This research is an observational study with a retrospective descriptive approach. This research was conducted at RSHS Bandung in January 2018 - December 2019. The population and sample of this study were all medical records of a patient that had undergone ORIF treatment at the Oral Surgery Clinic RSHS. The research use inclusion and exclusion criteria. The inclusion criteria in this study were all post-operative patients who had received ORIF treatment at the Oral and Maxillofacial Surgery Clinic RSHS, aged over 8 years and complete medical records of those patients. The exclusion criteria were patients under 8 years old from medical records. Data collection was carried out by the total sampling method using medical records of all ORIF patients, which were then collected and then assessed. The variables that were studied included age, gender, fracture area, diagnosis, duration of surgery, number of plates and screws, pre-surgical (pre-op), and post-surgical (post-op) pain based on NRS as measured every 8 hours postoperatively for 24 hours (Figure 1). According to Pagé, M. Gabrielle, et al (2012) the research instruments used consisted of a pain observation chart of NRS because it's reliable and valid for measuring pain intensity inpatient older than 8 years.<sup>15</sup> NRS consisted of numbers from zero to ten to assess the pain threshold of patients.

Component	Date: / /	Date: / /	Date: / /	Date: / /	Date: / /	Date: / /	Date: / /	Date: / /
	Time: Pre-op	Time: Post-op	Time: ...	Time: 8 hours	Time: ...	Time: 16 hours	Time: ...	Time: 24 hours
<p style="text-align: center;"><b>Numerical Rating Scale</b></p> <p style="text-align: center;">0 1 2 3 4 5 6 7 8 9 10</p> <p style="text-align: center;">None Mild Moderate Severe</p>								

**Figure 1.** NRS tool to measured pain intensity pre-op, post-op, and every 8 hours postoperatively for 24 hours.

The categorical data processing was carried out using a computer program and the research data were grouped and expressed in proportions. This study has received ethical approval from the Health Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung with the ethical committee approval number: LB.02.01/X.6.5/162/2020.

## 3. RESULTS

Research samples that meet the inclusion criteria are 65 samples. There were 13 data excluded because the expected data were inept and incomplete. Post-ORIF patient characteristics data at the Oral and Maxillofacial Surgery Clinic RSHS from 2018 to 2019 are presented in Table 1.

The most frequent age of the subject was a young adult group (17-30 years) with a percentage of 56.92%, and the most frequent gender was male with a percentage of 86.15%. Most of the patients who underwent elective ORIF surgery were due to motorbike accidents.

The most frequent fracture area was at the mandible area with a percentage of 48.67%, and the most frequently performed surgery was at the mandibular area with a percentage of 60.46%. Some of the other fracture locations were not treated with ORIF surgery because there was no functional abnormality and no distant displacement occurred. Most of the operations lasted for 61 - 120 minutes, with a percentage of 32.30%. The most widely used plates in each patient are plates (1-10 holes) and plates (11-20) holes with the same percentage of 38.46%, and the most utilized screws were screws (1-10) with a percentage of 49.23. %. The most common type of analgesic used was Ketorolac with a percentage of 87.69%, and the least used analgesic was Ketoprofen suppository with a percentage of 3.07% which was commonly used for pediatric patients.

This type of surgery was considered minor surgery with an NRS scale of 1-3. In this study, the average patients who underwent ORIF surgery showed mild pre-surgical pain with a percentage of 92.30%, and mild post-surgical pain with a percentage of 95.38%. The pain intensity was then measured every 8 hours for 24 hours by obtaining the intensity of pain for the first 8 hours, the next 16 hours, and the next 24 hours, which all showed the same intensity, namely mild pain with a percentage of 98.46%.

**Table 1.** Characteristics of post-ORIF patient subjects at the Oral and Maxillofacial Surgery Clinic RSHS in 2018-2019.

No	Variable	Frequency	Percentage (%)	
1.	Age	Children (>8 – 16)	11	16,92
		Young Adult (17 – 30)	37	56,92
		Middle Adult (31 – 45)	12	18,46
		Advanced Adult (>45)	5	7,69
2.	Gender	Male	56	86,15
		Female	9	13,84
3.	Fracture Area (Each patient may suffer more than 1 fracture area)	Frontal	4	3,53
		Nasal	6	5,30
		Maxilla	25	22,12
		Zygoma	23	20,35
		Mandible	55	48,67
4.	Diagnosis Post ORIF (Each patient may experience more than 1 surgery area)	Frontal	-	-
		Nasal	-	-
		Maxilla	23	26,74
		Zygoma	11	12,79
		Mandible	52	60,46
5.	Duration of Surgery	0 – 60 minutes	2	3,07
		61 – 120 minutes	21	32,30
		121 – 180 minutes	17	26,15
		181 – 240 minutes	14	21,53
		> 240 minutes	11	16,92
6.	Plate	Plate (1-10 hole)	25	38,46
		Plate (11-20 hole)	25	38,46
		Plate (> 20 hole)	15	23,07
7.	Screw	Screw (1-10 pieces)	32	49,23
		Screw (11-20 pieces)	23	35,38
		Screw (>21 pieces)	10	15,38
8.	Medication post ORIF	Ketorolac	57	87,69
		Tramadol	6	9,23
		Ketoprofen	2	3,07

9.	Pre-surgical pain intensity (Pre-op)	No Pain	4	6,15
		Mild Pain	60	92,30
		Moderate Pain	1	1,53
		Severe Pain	-	-
10.	Post-surgical pain intensity (Post-op)	No Pain	-	-
		Mild Pain	62	95,38
		Moderate Pain	3	4,61
		Severe Pain	-	-
11.	Post-surgical pain intensity (8 hours)	No Pain	-	-
		Mild Pain	64	98,46
		Moderate Pain	1	1,53
		Severe Pain	-	-
12.	Post-surgical pain intensity (16 hours)	No Pain	-	-
		Mild Pain	64	98,46
		Moderate Pain	1	1,53
		Severe Pain	-	-
13.	Post-surgical pain intensity (24 hours)	No Pain	-	-
		Mild Pain	64	98,46
		Moderate Pain	1	1,53
		Severe Pain	-	-

Note: Categorical data was presented with number/frequency and percentage

#### 4. DISCUSSIONS

Based on this study, young adults were the most often age group to experience traffic accidents, and most of them were males. In the last two years, World Health Organization (WHO) has considered traffic accidents as the third biggest killer in Indonesia after coronary heart disease and tuberculosis/TB. WHO data in 2011 states that 67% of traffic accident victims are at the productive age of 22-50 years. There are about 400,000 victims under the age of 25 who died on the road, with an average death rate of 1,000 children and adolescents each day. Traffic accidents are the main cause of death for children in the world, with an age range of 10-24 years.<sup>16</sup> According to Leles (2010), the dominance of male patients is because men are the workers of the family and most of them work outdoors, therefore they are prone to have a high risk of accidents on the highway.<sup>17,18</sup>

The most frequent location of fracture that occurs in the oral and maxillofacial area was at the mandible, along with the most frequent surgery area. Based on research conducted by Samieirad (2017) on the anatomical location of maxillofacial fractures of 502 patients, it was stated that mandibular fractures occupied the highest frequency (58.8%), followed by zygomaticomaxillary complex (ZMC) fractures (36.7 %) and nasal fractures (18.33%).<sup>19</sup> The mandible has a high incidence of fracture, this is because it is more prominent and its position on the facial skeletal bone makes it prone to trauma.<sup>20</sup> Maliska (2012) in Brazil reveals that the most commonly affected are the condyles of the mandible, this tendency is due to the protrusion of the mandible and the fact that it is the only movable bone in the maxillofacial region.<sup>21</sup>

The maximum duration of surgery is 61-120 minutes. The most widely used plates and screws are 1-10 holes and 11-20 holes. In some cases, ORIF surgery may take several hours and varies based on the level of difficulty of the area to be operated on, and also the type and location of the fractured bone.<sup>11</sup> The usage of plates and screws also depends on the necessity according to the location and extent of the fracture. The purpose of using plates and screws is internal fixation, and the open reduction and



internal fixation techniques for facial bones that can be used are the orthopedic principles, namely reduction and bone fixation, for healing to occur.<sup>11,22</sup>

The types of analgesics used such as Ketorolac, Tramadol, and Ketoprofen suppository are not only used in the mild pain type of surgery, but also for moderate pain type of surgery. Ketorolac, Tramadol, and Ketoprofen are drugs that can be used to reduce post-surgical pain. In this study, Ketorolac was used in almost all patients with mild pain. Tramadol was used in 6 patients with moderate pain and several mild pain patients. Ketoprofen suppository was usually used in post-ORIF child patients with mild pain. Ketorolac is an NSAID class drug that acts on the transduction pathway and inhibits the prostaglandin biosynthesis process through inhibiting cyclooxygenase actions, Tramadol is an opioid class drug that acts on the central nervous system and inhibits perceptual processes, and Ketoprofen works by inhibiting the cyclooxygenase pathway of arachidonic acid metabolism.<sup>23,24</sup> According to Barden et al. in 2009, Ketoprofen is an NSAID drug and has been widely used as a post-surgical analgesic and is effective for moderate to severe pain.<sup>25</sup> A study conducted by Velásquez, Santa Cruz, and Espinoza in 2014 showed that Ketoprofen was more effective than Ketorolac as an analgesic after oral surgery.<sup>26</sup>

The NRS measurement scale is a subjective method of measuring pain intensity that allows the patient to select pain from a scale of 0 to 10. This scale is excellent for assessing pain intensity before and after therapeutic interventions. This scale gives the patient total freedom and identifies the severity of the pain that is felt. The level of pain is obtained through reports from the patient by stating the number on the NRS pain scale, with a pain scale ranging from 0 to 10. The score results of 0 mean no pain category, a score of 1 - 3 belongs to the mild pain category, a score of 4 – 6 belongs to the moderate pain category, and a score of 7-10 belongs to the severe pain category. The NRS pain scale measurement is recommended for acute pain and surgery in patients older than 8 years. In a study conducted by Brunelli et al. (2010), it was found that pain evaluation cannot be completed by the patient alone, but rather managed by a trained nurse or doctor who can help patients better understand the question. Some patients who do not give consent may have physical or cognitive impairments and this could contribute to improved compliance with pain assessments. Although good adherence in the use of the NRS scale has been confirmed in clinical use, the application of this scale must be verified under different conditions such as self-data collection and repeated use.<sup>9,15,27</sup>

Most of the patients who had undergone ORIF at the Oral and Maxillofacial Surgery Clinic presented mild pain with a pre-surgical and post-surgical NRS score of <4. Pre-surgical pain intensity presented mild pain, it is because almost all patients which plan to perform surgery at Oral and Maxillofacial Surgery Clinic weren't emergency operation and plan to perform ORIF electively. Post-surgical pain intensity observed every 8 hours for 24 hours did not show a significant change because it has the same results as mild pain. Several factors may influence this result, including the effect of the analgesic drug administered, the number of fracture sites, the operation performed, the number of plates and screws placed, the size of the surgical wound, and the patient's subjective assessment in determining the NRS scale. Based on research conducted by Caesario in 2017, the ORIF procedure is more often used in fracture cases, to reduce pain, restore bone function, and preventing further injury.<sup>11,28</sup> According to Sinatra et al. (2009) the intervention of mild acute pain can be done by administering NSAID and PCT; moderate

acute pain can be done by administering NSAID, weak opioid, and adjuvant therapies; and severe acute pain can be done by administering strong opioid such as morphine and combined with NSAID accompanied adjuvant drugs.<sup>29</sup> So, it is possible that almost all post-surgical patients had mild pain because of the effects of analgesic drugs administered as indicated.

The NRS measurement scale is considered simple and easy to understand, sensitive to dose, gender, and ethnic differences. However, some of the drawbacks are the limited choice of words to describe the pain, the lack of possibility to distinguish the level of pain more precisely, and it is assumed that there are equal distances between the words that describe the analgesic effect. There were several procedures to collecting NRS data, it can be administered verbally, where patients are asked to rate their pain and the evaluator records the value. They may also be applied in written form such as the patient marking the numbers on the straight line that has been provided, and the patient marking with a point where the patient's pain scale is felt. Furthermore, for interpretation, it is seen directly where the patient gives a sign for the scale of the pain they feel.<sup>30</sup> This study has several weaknesses in its implementation because the NRS pain measurement scale is taken from medical records filled in by different evaluators, which allows each individual to collect data unsuitably with the NRS data collecting procedure.

## 5. CONCLUSION

Characteristics of pain based on NRS in maxillofacial trauma patients treated with ORIF indicate mild pain and could be the result of the influence of Ketorolac drugs or subjective assessments, therefore, further research is needed to obtain a more precise assessment of the pain.

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**Conflict of Interest Statement:**

The author declares that the case report was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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