



## **The Quality Characteristics of Distal Radius Fractures in Patients Admitted to Emergency Department Dr. Moh. Hoesin Hospital Palembang during January-December 2020**

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### **ABSTRACT**

Fracture cases increases in globalization era. The 8-15% reported cases were distal radius fracture (DRF). The epidemiology data is the foundation of diagnostic and management for DRF patients. However, this has not been studied in Indonesian patients. As a result, the authors decided to study the picture of DRF patients in the Indonesian subpopulation, especially in the Central General Hospital Dr. Mohammad Hoesin (RSMH) Palembang. This research is a descriptive observational study at RSMH Palembang in January-December 2020 with variables of age, sex, mechanism of injury, types of fractures, radial inclination and volar tilt as the parameter of DRF severity. All of these variables are components of the assessment on the medical record. The data in this study were 29 cases and described with the age, sex, mechanism of injury, types of fractures, radial inclination and volar tilt. The most common DRF occurred at the youth age between less 13-25 years (41.4%). DRF happened more in male (75,9%) patients than the female (24.1%) ones. The most common type of fracture is Colles (44.8%). Motorcycle crash (58.6%) is the most common mechanism of injury in DRF. The abnormal radial inclination occurred in 82% cases. Severe volar tilt counted 85% of DRF in this study. DRF happened mostly in youth, male, and motorcycle crash. Colles fracture is the most commonly type of DRF case.

### **1. Introduction**

Fractures pose an increasing burden to healthcare resources due to changing population demographics and increasingly complex and expensive management strategies. Accurate understanding of fracture epidemiology is therefore essential to assist with allocation of healthcare resources.<sup>1</sup> Distal radius fractures (DRFs) are one of the most common injuries encountered in orthopedic practice.<sup>1-3</sup> Abraham Colles is credited with description of the most common fracture pattern affecting distal end radius in 1814, and is classically named after him. Colles' fracture specifically is defined as metaphyseal injury of cortico-cancellous junction (within 2-3 cm of articular surface) of the distal radius with characteristic dorsal tilt, dorsal shift, radial tilt, radial shift, supination

and impaction. Smith's fractures, also referred to as reverse Colles' fracture, have palmar tilt of the distal fragment. Barton's fracture is the displaced intra-articular coronal plane fracture-subluxation of dorsal lip of the distal radius with displacement of carpus with the fragment.<sup>2</sup>

Distal radius fractures make up 8%-15% of all bony injuries in adults.<sup>2,3</sup> The number of distal radius fracture cases is one sixth of all fractures with more than 640,000 cases recorded in 2001 only in the United States. In Sweden, the incidence of distal radius fractures is 24 per 10,000 people / year. Where the ratio between women and men is 3:1. The increase in the incidence of distal radius fractures is proportional to the increase in age. The incidence of

distal radius fractures under the age of 50 years is around 9 per 10,000 people / year regardless of gender. In women, the incidence of fractures increases sharply from above 50 years of age and doubles with each 10-year age interval to 70 years and reaches a peak after 90 years of age, 144 per 10,000 people / year.<sup>4</sup>

The distribution of DRFs in the general population is bimodal with incidence peaks in young men and in post-menopausal women. DRFs in younger patients with good bone stock are most commonly associated with high-energy trauma, while low-energy trauma is the most likely mechanism of injury in older patient due to underlying osteopenia/osteoporosis.<sup>1,5</sup> The most common trauma mechanism is a fall onto the hand, in hyperextension. The characteristics of the fracture (location of the fracture line, presence or absence of joint impairment, degree of comminution and degree of injury to soft tissues) are directly related to the trauma energy, angle of the wrist at the moment of the trauma and bone quality. These are essential for the fracture classification and treatment plan.<sup>6</sup>

As mentioned above, the incidence of DRF is positively associated with age, sex and increased physical activity levels. These issues underline the need for this review, which aims to summarize the literature reporting on DRF incident, risk factors, as well as the mechanism of injury, classification of fracture and prognostic factors, especially in Dr. Mohammad Hoesin Hospital Palembang.

## **2. Research Methods**

This type of research is descriptive-retrospective using secondary data in the form of patient's medical records. The technique used in the collection of samples in this study was total sampling, in which the samples in this study were all patients with distal radius fractures whose complete medical records were recorded and treated at Dr. Mohammad Hoesin Hospital.

The study was conducted at Dr. Mohammad Hoesin Hospital Palembang from January 2020 until

December 2020. This research is using total sampling for the sample, which diagnosed with distal radius fracture and admitted to Dr. Mohammad Hoesin Palembang Hospital. The inclusion criteria is the patient with DRFs who admitted to the Emergency Room at Dr. Mohammad Hoesin Hospital in one year period from September 2019 to August 2020 with complete medical record which included name, sex, age, and complete history. The exclusion criteria is the patient with incomplete data of the medical record.

Age is defined as the length of time during which a person has existed based on WHO Classification. The categories of age are childhood (1-13 years), youth (13 – 25 years), young (25-44 years), middle age (44-60 years), and elderly (> 60 years).

The mechanism of injury is the force or forces that cause injury when applied to human body. This ordinal variable is divided into car crash, motorcycle crash, pedestrian injuries, falls, violence, and others. The types of fracture is the break in the structural continuity of bone. This ordinal variable is categorized as Colles, Smith, and Barton.

Data obtained will be analyzed using SPSS v.23 and processed through these following steps. Data editing is done to make sure the data collected match the criteria. In the coding step, researcher put the code for every information. Scoring is given for the format, and to transform quantitative data into qualitative data to simplify the data analysis. In data entry step, all the data that is completed (editing and coding), will be put in to the software. In data cleaning, reviewing is conducted to these data that has been put on to the software, to make sure that there is no mistake. After that, data analysis will take place using SPSS. Data analysis performed to answers the research and verify the hypothesis. Data analysis performed using the univariate analysis (descriptive). Univariate analysis is effective to summarize the data from the measurement with statistically descriptive, so all the random data is arranged and easy to access. This research was proposed to Health Research Review Committee of Dr. Mohammad Hoesin Hospital and Faculty of Medicine

Table 1. General Characteristics of Research Subjects

	Characteristics	N	%
Age	1 - 13 years (Childhood)	4	13.8
	13-25 years (Youth)	12	41.4
	25-44 years (Young)	4	13.8
	44-60 years (Middle age)	6	20.7
	>60 years (Eldery)	3	10.3
Sex	Male	22	75.9
	Female	7	24.1
Mechanism of injury	Car Crash	2	6.9
	Motorcycle Crash	17	58.6
	Falls	7	24.1
	Violence	2	6.9
	Others	1	3.4
Types of fracture	Colles	13	44.8
	Smith	10	34.5
	Barton	6	20.7
Severity	Radial inclination	24	82
	Volar tilt	25	85

### 3. Results

Based on this research result, the most common patient age category was youth (13-25 years old) which counted 41,4% total DRF admitted in ER Dr. Mohammad Hoesin Hospital during January – December 2020. The least age category was the elderly patient (>60 years). However, childhood (1-13 years) DRF patient is more than the middle (44-60 years) age category (20.7%).

In 2020, male distal radius is more common for undergoing fracture compared with the females' one. The DRF admitted in ER Dr. Mohammad Hoesin Hospital incidence in male is 3 times more than female during January – December 2020. Colles is the most (44.8%) DRF type admitted in ER Dr. Mohammad Hoesin Hospital during January – December 2020. Smith fracture counts 34,5% and Barton fracture is 20.7% of all DRF cases in RSMH last year.

From all DRF cases admitted in ER Department during 2020, motorcycle crash is the most

mechanism of injury (58.6%). Violence and car crash counted 6.9% cases. Falls counted 24.1% DRF in ER Dr. Mohammad Hoesin Hospital last year.

### 4. Discussion

DRF happened most commonly (41.4%) at 13-25 years old as the patient age category who admitted in ER Dr. Mohammad Hoesin Hospital during January – December 2020. This age characteristic was different with the cohort prospective research which was done by Sander et al in 2020. They concluded that the average age of the DRF patients was 56.9 (18–99) years.<sup>1</sup> A total of 23,394 distal radius fractures in 22,962 patients were identified. DRF case in RSMH last year was also different from the cohort prospective research result done by Rundgren et al., in Swedish. The mean age of DRF patient was 62.7 ± 17.6 years for all, 65.4 ± 16.0 for women and 53.6 ± 20.0 for men.<sup>2</sup> The observational study done by Johnson et al in United Kingdom during 2019 showed that mean age in the most deprived two quintiles was

54.4 years compared to 60.1 years in the least deprived three quintiles.<sup>3</sup> Reduced Bone Mineral Density (BMD) is an important risk factor for low-energy distal radius fracture in men.<sup>3</sup> BMD decreases in demineralization cases such as osteoporosis or the systemic lupus erythematosus.<sup>4,5</sup> Steroid and tobacco consumption in youth can increase the DRF risk factor because of the secondary osteoporosis.<sup>6-8</sup>

DRF happened more commonly (75.9%) at male than female (24.1%) patient who admitted in ER Dr. Mohammad Hoesin Hospital during January – December 2020. This sex characteristic was different with the incidence in women was 34 (95% CI 30–39) and in men was 10 (95% CI 8–12) per 10,000 according to the epidemiological study done by Eiriksdottir et al in Sweden.<sup>9</sup> Young men with DRF have significantly lower estradiol and higher luteinizing hormone compared to controls. No difference was observed in either total or calculated free testosterone. Estrogen is a strong determinant of bone mass also in men, hence the low levels of estradiol may be a contributing factor to the lower BMD and accelerated bone loss in men with DRF.<sup>10</sup> Sex hormone profiles may be disturbed with a lower total estradiol (E2)/ sex hormone-binding globulin (SHBG) ratio, lower calculated free testosterone (CFT), and higher luteinizing hormone (LH). Estrogen is also a strong determinant of bone mass in men; hence, low levels of E2 may be contributing to the observed lower BMD and these differences may be relevant to fracture risk.<sup>11</sup>

Colles is the most (44.8%) DRF type admitted in ER Dr. Moh. Hoesin Hospital during January – December 2020 compared to Smith (34.5%) and Barton (20.7%) fracture. This result was similar to the 30-year period followed up done by Owen et al toward 1,137 adult residents of Rochester, Minnesota experienced 1,235 Colles' fractures which the incidence increased over sixfold between ages 35-39 and 60-64 and then leveled off.<sup>12</sup> A Colles' fracture is one of the most common types of osteoporotic fractures seen, especially in females above the age of 50. Incidence of men vs. women over the age of 35 was 9/10,000 vs. 37/10,000, respectively.<sup>13</sup> A

pregnant woman can be presented with Barton fracture at 37 weeks of gestation as the result of Pregnancy and lactation-associated osteoporosis (PLO).<sup>14</sup> Smith's fracture results from falling on the palm of the hand.<sup>15</sup> In fractures of the distal radius, the type of displacement has no significant effect on the final outcome of surgical plate fixation. In fractures with dorsal displacement of fragments, it is more difficult to restore volar tilt from a volar approach.<sup>16</sup>

From all DRF cases admitted in ER Department during 2020, motorcycle crash is the most mechanism of injury (58.6%), followed by violence and car crash counted (6,9%), and falls (24.1%). Compared to MacIntyre and Dewan literature review in 2016, the most common causes of DRF in the pediatric and young adult age groups include playing/sporting activities and motor vehicle accidents. In contrast, the most common mechanism of injury in older adults is a low-energy trauma because of a fall from a standing height.<sup>5</sup> DRF patients' mechanism of injury characteristic was also different from the result of Solvang et al epidemiology study in 2018 that reported falling while walking outside was the most common mechanism of injury.<sup>17</sup> A fall on the outstretched hand from a standing position is the most common mechanism of injury in retrospective cohort study included all patients aged 16 years and above with distal radius fractures seen between November 2008 and May 2009 by the Department of Hand and Reconstructive Microsurgery at the Singapore National University Hospital.<sup>18</sup>

In 2020, the abnormal radial inclination (82.8%) of distal radius fracture is more common than the normal one (17.2%). The abnormal volar tilt (86.2%) of distal radius fracture is more common than the normal one (13.8%). Radial inclination is a measurement made on the AP projection of the wrist as an angle of the distal radial surface with respect to a line perpendicular to the shaft.<sup>19</sup> The category of radial inclination is divided into normal (19-28°) and abnormal (<19° or >28°). The measurement of radial inclination uses the radiograph evaluation after DRF treatment.

The anatomy of the distal radius is complex. The articular surface of the distal radius has a radial inclination of approximately 21 degrees in the coronal plane and a volar tilt of approximately 11 degrees in the sagittal plane. The dorsal border is convex and irregular. In the midportion is Lister tubercle, a bony prominence that acts as a pivot point for the extensor pollicis longus (EPL) tendon. The volar border of the distal radius is relatively flat, except for the very distal margin that projects approximately 3 mm in volar direction to form a ridge from which the volar radiocarpal ligaments originate. Only the brachioradialis tendon inserts onto the distal radius, and its insertion is at the radial base of the styloid, on the floor of the first dorsal extensor compartment.<sup>20</sup>

Volar tilt is a measurement made on the lateral projection of the wrist as an angle of the distal radial surface with respect to a line perpendicular to the shaft.<sup>21</sup> Volar tilt is categorized into normal (7-15o) and abnormal (<7 or >15). Volar tilt is evaluated after DRF treatment. Comminuted and displaced extra-articular fractures (Smith's fractures), die-punch fractures, and progressive loss of volar tilt and radial length following closed reduction and casting is also the indication of ORIF in DRF. ORIF using a plate has advantages for the restoration of anatomy, as it allows superior visualization, better mechanical stability, and a shortened immobilization period than cast immobilization or external fixation do.<sup>22</sup>

## 5. Conclusion

DRF happened mostly in youth, male, and motorcycle crash cases among the patients admitted in ER Dr. Mohammad Hoesin Hospital during January – December 2020. Colles fracture is the most commonly type of DRF case. Further analytical research of DRF, like the comparison of surgical and conservative DRF treatment, is essential. The more sample and variable used, the better continuous DRF registry and clinical research will be gotten.

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