
Treatment of wrist fractures 2009–14

ORIGINAL ARTICLE

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BACKGROUND

The purpose of the study was to conduct a systematic analysis based on data from the Norwegian Patient Registry and describe the incidence and treatment of wrist fractures among adults, at national level and in the catchment areas of the various regional health authorities.

MATERIAL AND METHOD

A search was conducted in the Norwegian Patient Registry for all patients aged ≥ 18 years with diagnosis codes for wrist fractures in the period 2009–2014. Age, sex and type of treatment were recorded. The results are presented as rates adjusted for age and sex for the catchment areas of Norway's 21 regional health authorities.

RESULTS

In the period 2009–2014, a total of 75 132 patients aged ≥ 18 years were registered as having a wrist fracture. Almost 1/3 of these patients received operative treatment. During this period, the age- and sex-adjusted rate of wrist fractures in Norway averaged 244 per 100 000 inhabitants per year. Operation rates varied across catchment areas by a factor of three, and the use of plates by a factor of nine.

INTERPRETATION

We found great variation in clinical practice, which is reflected in differences in operation rates and choice of surgical method across the catchment areas to which the patients belong.

Main points

We found major geographical differences in the use of operative treatment for wrist fractures

There were major geographical differences in the types of operative method used

We found a shift in operative treatment over time from percutaneous pinning and external fixation towards open reduction with plate osteosynthesis.

Wrist fractures are the most frequently occurring fracture type in Norway (1, 2). Previous estimates based on incidence rates from Bergen and Oslo indicate an incidence of more than 15 000 of these fractures annually among adults in Norway (1–3). The incidence is regarded as among the highest in the world (2). Elderly women are affected most frequently, and it is estimated that about 10 % of all 65 year-old women will incur a wrist fracture at some point in their lives (4). Fractures suffered by elderly women are typically low-energy injuries, while fractures suffered by men are more often a result of high-energy trauma (5, 6). Until 2005, these fractures in the elderly were usually treated conservatively, with reduction when necessary and a plaster cast (7). It was believed that hand function would be the same as before the fracture, despite the fact that half of the patients would end up with malunion (7, 8). Most of the studies that revealed acceptable function after conservative treatment included elderly patients who were frail or already had a low functional level prior to the fracture (9–11). A prospective cohort study involving 6 107 elderly women was published in 2010. It showed that a wrist fracture is a significant cause of loss of self-sufficiency (12).

Operative treatment has always held a prominent place in the treatment of younger patients with unstable fractures, and with the introduction of new, volar locking plates in 2000, the proportion of operations using plates has increased (13). The increase took place without evidence that the plates were superior to ordinary plates or pins and external fixation, but indicated the possibility of also using operative treatment for comminuted fractures. Patients with cognitive impairment are often treated conservatively, but it is increasingly common for cognitively unimpaired elderly people with displaced fractures to be treated operatively with volar plate fixation (7).

Although one of the ultimate aims of the Norwegian health service is equal treatment across age, geographic, ethnic and social groups (14), the Norwegian orthopaedic medical community is of the view that practice varies substantially when it comes to treatment of wrist fractures (3, 14). Many Norwegian hospitals aim for differentiated, well founded treatment, but some have a more limited choice of treatment methods. This may be very important to patients, who expect optimal treatment irrespective of the location of the hospital. Figures from the Norwegian System of Patient Injury Compensation (NPE) showed that wrist fractures are one of the most frequent causes of complaint cases that are won by patients. Wrist fractures are expected to become a growing socioeconomic expense in view of the aging population (17).

In 2013, the Norwegian Orthopaedic Association established evidence-based guidelines for wrist fractures among adults in order to bring about a harmonisation of practice (18). These guidelines were drawn up in accordance with new international standards for reliable guidelines (19) and the Norwegian Directorate of Health's *Veiledning for utvikling av kunnskapsbaserte retningslinjer* [Guide to drawing up evidence-based guidelines] (20), and have

been published on the electronic platform MAGICapp. The guidelines represent a new generation tool for evidence-based support in clinical practice, in which both guidelines and knowledge base are readily available to users.

In order to bring about an improvement in treatment strategies and measures to prevent wrist fractures, it is important for administrative and medical staff to be familiar with the incidence of wrist fractures and with current practice. However, there are no published national incidence rates or data on treatment practice in the different geographical regions of Norway. The purpose of this study was to perform a systematic analysis of the incidence of wrist fractures among adults, both nationally and at regional health authority level, based on figures from the Norwegian Patient Registry, and to survey differences in usage and practice across the catchment areas of the regional health authorities.

Material and method

Data

The Northern Norway Regional Health Authority's Centre for Clinical Documentation and Evaluation has authorisation from the Norwegian Data Inspectorate and exemption from the duty of confidentiality from the Regional Ethical Research Committee (REK). The authorisation allows access to unique personal data from the patient registry with information about patients treated at Norwegian hospitals in the period 2009–2014. Encrypted patient serial numbers make it possible to monitor patients anonymously over time. In addition to selected patient data, such as place of residence, age and sex, the authorisation allows access to some administrative and medical data, such as institution, diagnostic codes (ICD-10) and procedure codes (Norwegian Classification of Medical Procedures (NCMP) and Nordic Classification of Surgical Procedures (NCSP)). The authors bear the sole responsibility for the interpretation and presentation of data supplied by the Patient Registry.

Selection

The dataset includes adult patients ≥ 18 years with wrist fractures in the period 2009–2014. A wrist fracture is defined as a distal radius fracture (ICD-10 diagnostic code S52.5) or a distal radius and ulna fracture (ICD code S52.6). Patients who received a new fracture diagnosis within 180 days of the first fracture were excluded to avoid erroneous inclusion of follow-up and rehabilitation of the same condition. Surgical treatment of wrist fractures was defined according to the NCSP codes NCJ25, NCJ27, NCJ35, NCJ37, NCJ45, NCJ47, NCJ55, NCJ57, NCJ65 and NCJ67, which represent external fixation and osteosynthesis by means of bioimplants, pins, intramedullary nailing and plates. Conservative treatment was defined as wrist fractures without operative procedure codes. A total of 2 291 patients were excluded, mainly because they were not domiciled in Norway. Intramedullary nailing (about 15 cases per year) is counted as a surgical procedure, but is not included in the analysis (Fig. 1).

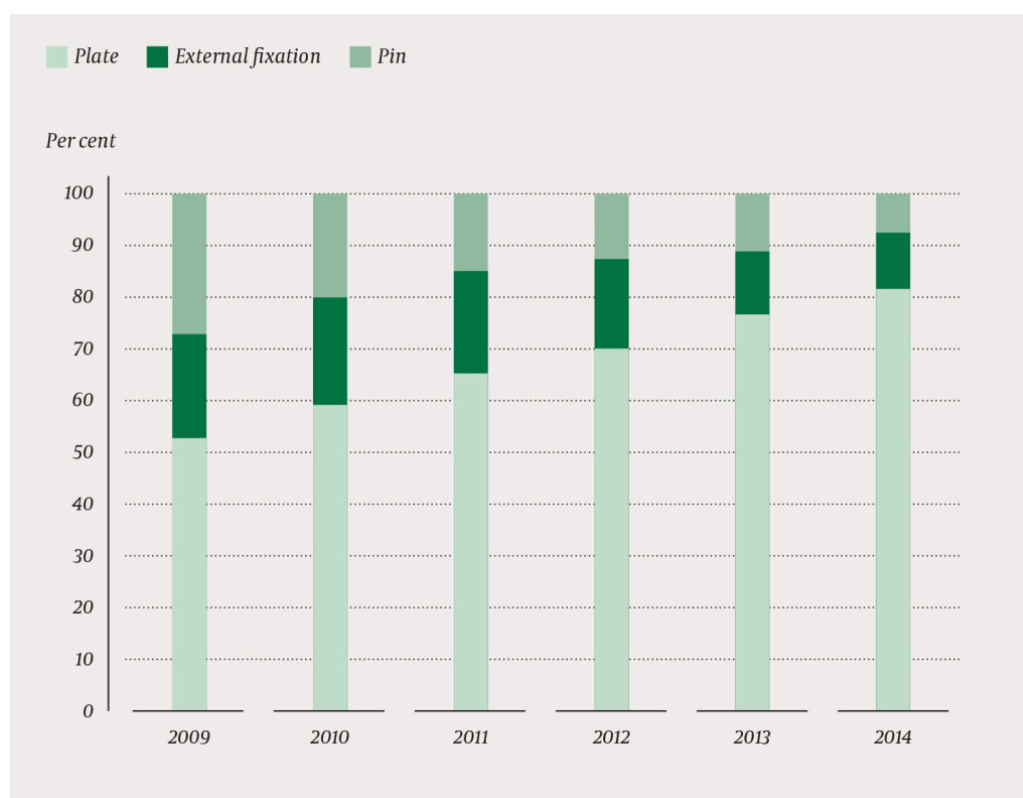


Figure 1 Operative methods for treating wrist fractures. Percentages of plates, external fixation and pins per year, 2009–2014.

Method

The data were analysed using the SAS 7.1 software package. In order to permit comparison of the incidence of wrist fractures and the use of operative techniques in the catchment areas, which have populations that differ in numbers and in age and sex composition, the analyses of variation in usage are based on estimated usage rates. Rates are calculated per 100 000 inhabitants. The direct method, which is a method that estimates the rate the catchment areas would have had if age and sex composition had been the same as for the country as a whole, is used in the adjustment. Norway's population in 2014 is used as reference population.

Results

Incidence of wrist fractures

In the period 2009–2014, a total of 75 132 patients aged ≥ 18 years were treated for wrist fractures in Norway. The numbers of wrist fractures varied somewhat through the period, with the highest number in 2013 (13 387) and the lowest in 2014 (12 154). The mean rate or incidence, adjusted for age and sex, is thus 244 wrist fractures per 100 000 inhabitants per year during the period. The Førde catchment area (highest) had a rate that was 1.3 times as high as the Telemark catchment area, which had the lowest rate. Otherwise there was little variation in the incidence of wrist fractures in Norway (Fig. 2).

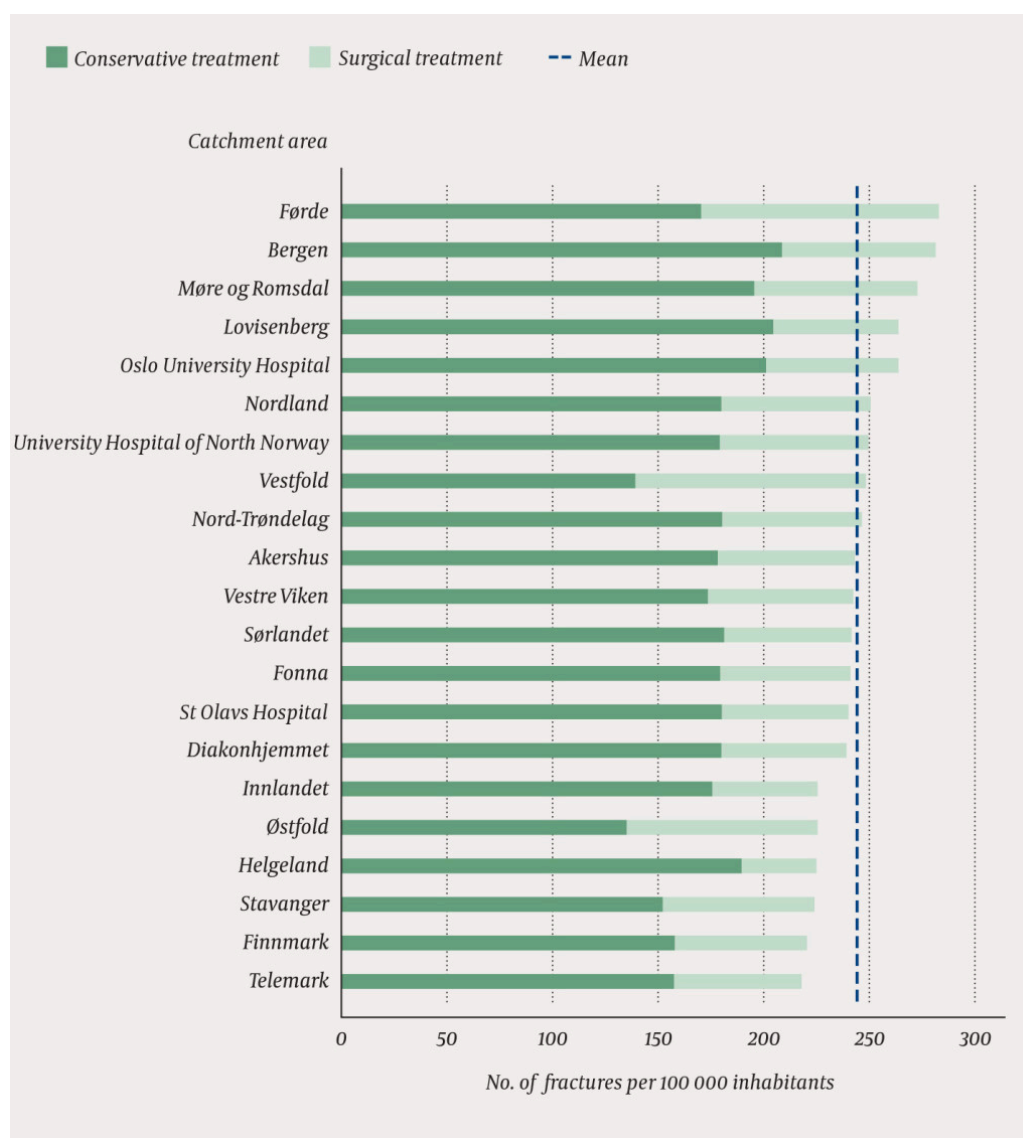


Figure 2 Number of wrist fractures by treatment method and catchment area, rates per 100 000 inhabitants adjusted for sex and age; mean 2009–2014

The mean age of patients treated for a wrist fracture was 63.5 for women and 50.1 for men, with standard deviations of 17 and 19 years, respectively. Women accounted for 75 % of patients. There was a sharp increase in the incidence of wrist fractures in women from the age of 45. The increase slowed after the age of 60. Men had a considerably lower incidence of wrist fractures throughout their lives, as illustrated by the fact that only at the age of 75 did men have the same incidence of wrist fractures as women aged 45.

Operative treatment rates

At national level, 28 % of all patients received operative treatment during the period, and this proportion remained stable for the last five years of the period. The Helgeland catchment area had the lowest percentage during the period (16 %), and Vestfold the highest (44 %) (Fig. 3). More women aged 45–80 underwent operative treatment than other age groups, while the numbers of men who underwent operative treatment were approximately the same irrespective of age group. Of those who underwent operative treatment, 78 % were women. The mean age was 64.4 for women and 51.3 for men, with standard deviations of 13 and 16 years, respectively.

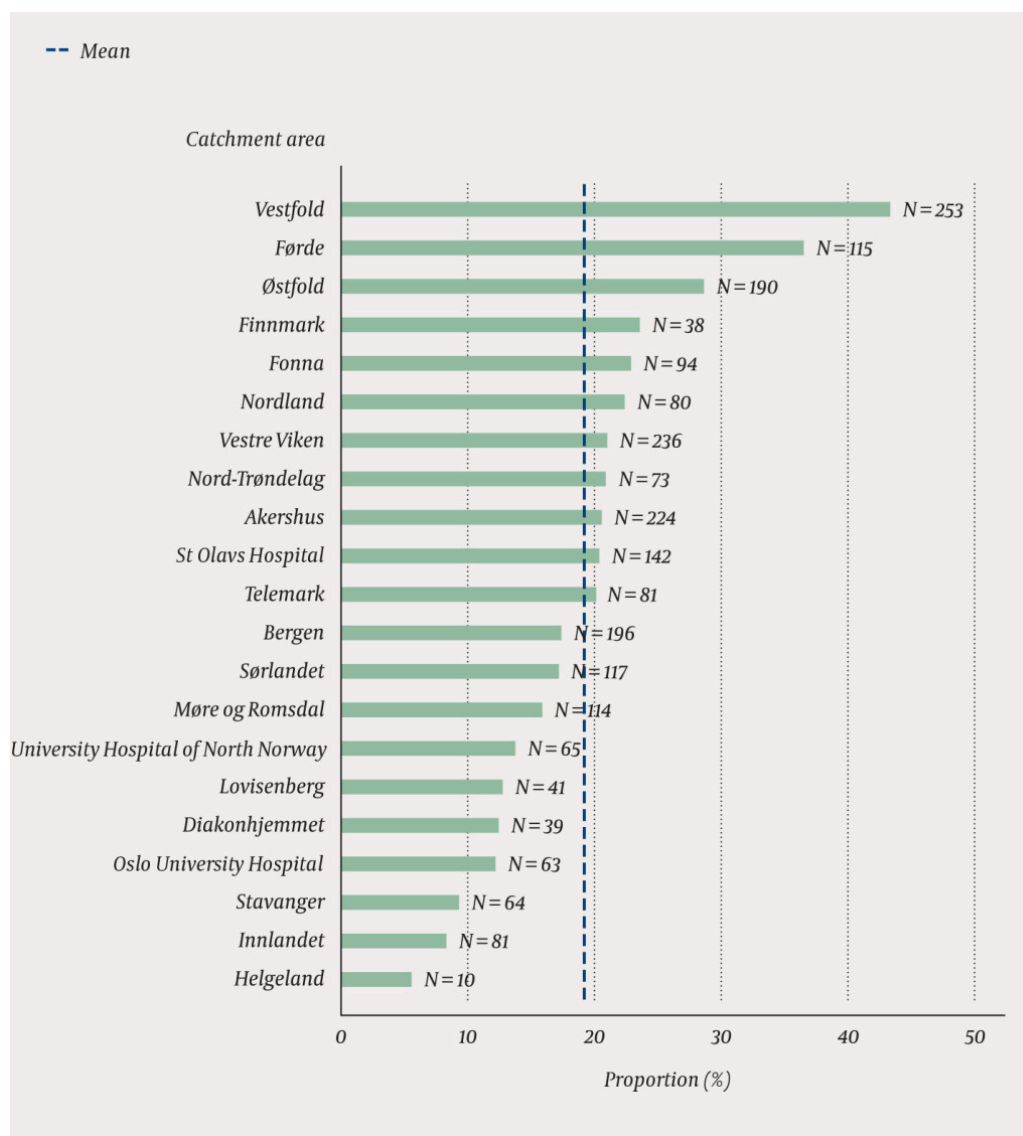


Figure 3 Wrist fracture treated with plates as a percentage of all sex- and age-adjusted wrist fractures, distributed by catchment area; mean 2009–2014. The mean number treated with plates per year is shown to the right of the columns (N).

Use of different operative techniques

At national level, the use of various operative techniques changed considerably during the period, with the use of plates increasing from 53 % in 2009 to 81 % in 2014 (Fig. 1). As the use of plates increased, a reduction was observed in the use of pins and external fixation. The numbers on whom plates were used varied within several individual catchment areas through the period 2009–2014. The use of plates varied by a factor of 8 between the Vestfold catchment area (43.4 %) and Helgeland (5 %) (Fig. 3). The most striking finding in the period was that the rates in the two areas with the highest plate operation rate were reduced in 2014.

Discussion

In this study, we observed a stable incidence of wrist fractures among adults in Norway in the period 2009–2014, with a mean age- and sex-adjusted rate of 244 wrist fractures per 100 000 inhabitants. This is the same incidence as in

Sweden and Finland in the same period (5, 6). Unchanged or reduced incidence is also seen in other countries, despite the aging population (2, 6). This trend is assumed to be attributable to a strong focus on prevention of osteoporosis in post-menopausal women through hormone replacement therapy, use of vitamin D and calcium, and also to the fact that they are more physically active (2, 6).

As expected on the basis of previous studies (2, 5), women accounted for around 3/4 of the patient population, with a higher mean age than men. Men have a substantially lower incidence of wrist fractures throughout their lives. The difference in incidence between men and post-menopausal women is assumed to be partly attributable to the difference in the incidence of osteoporosis. The incidence of wrist fractures varies relatively little among the catchment areas in Norway: Førde and Bergen, which had the highest rates, had a 1.3 times higher fracture incidence than Telemark, with the lowest rate.

In a countrywide, population-based historic cohort study of 1 000 hip fractures in Norway in which the data in the Norwegian Patient Registry were validated, high sensitivity for identification of hip fracture was found when the latter was defined using a combination of ICD-10 diagnostic codes and NOMESCO procedures codes (21). A combination of codes was also used in the present study. Thus, the difference in incidence that was identified cannot be explained as due to inaccuracy in the recording of patient data. In principle, treatment of wrist fractures is not sensitive to either preference or supply, since the treatment must be regarded as a necessary health service for those affected. A necessary health service is characterised by a documented effect, that there is little or no disagreement on the treatment and that the benefit exceeds any side effects or negative consequences (22). Nor, then, is the variation in incidence of wrist fractures likely to be due to patients in some areas showing a greater tendency to seek doctors attention after an injury. In the population-based study Cohort Norway, with more than 180 000 participants, it was found that the incidence of forearm fractures in both sexes rose with increasing urbanisation, and that patients in rural areas had higher bone density than patients in urban areas (23). However, this does not explain the differences in incidence observed in this study, since the catchment areas include both urban and rural areas.

Countrywide, the percentage of the total patient population with wrist fractures who received operative treatment was stable at around 28 % during the study period. This is in contrast to what is seen in other countries, where an increasing proportion undergo operative treatment (3). Figures from the Swedish fracture registry for the period 2004–2010 revealed a 40 % increase in operative treatment of wrist fractures concurrently with a fall in incidence (5). Figures from the Finnish Patient Registry showed a 50 % increase in the period 1998–2008 (24). The Swedish and Finnish studies did not specify the percentage of the total patient population with wrist fractures who undergo operative treatment. As with the figures from the Swedish fracture registry, there are small differences in sex and age composition between those who receive conservative treatment for wrist fractures and those who undergo operative treatment (5). An American study of Medicare data shows the same tendency, with the same operation rate as in Norway (17).

We found that there was variation in operation rates across the catchment areas of the various health authorities. Helgeland, with an operation rate of 16 %, and Førde and Vestfold with around 40 %, stood out. Defining observed variation as not justified or undesirable is difficult if the optimal treatment has not been clearly defined, as is the case for many treatment options [\(25–29\)](#). Unjustified variation in the use of health services implies an unequal distribution of health resources [\(30\)](#). In October 2013, the Norwegian Orthopaedic Association published treatment guidelines as decision-making support for treatment choices [\(18\)](#).

Whereas there was no change in the percentage undergoing operative treatment in the period 2009–2014, there was a change in the type of operative procedure chosen. We saw an increase in the use of plates, from 53 % to 81 % (Fig. 1), at the expense of percutaneous pinning and external fixation. Similar findings were made in Sweden, where the proportion for whom plates were used increased from 16 % in 2004 to 70 % in 2010 [\(5\)](#). The choice of volar locking plates rather than pins and external fixation is supported by metaanalyses published in the Norwegian treatment guidelines for wrist fractures [\(18\)](#).

This study showed that in catchment areas with the highest proportion of operative treatment and use of plates, both the operation rate and the rate of treatment with plates were reduced in the last year of the period. Similarly, the operation rate and rate of treatment with plates increased in some catchment areas with an operation rate lower than the national mean. This, too, indicates a change in the situation with respect to indication for surgery, but also a change in preferred surgical method. There is some literature to suggest that undesirable variation can be improved by receiving feedback about one's own practice [\(26\)](#). The orthopaedic surgery community has received feedback of this kind indirectly through the treatment guidelines and the attention they have received. Further changes can be expected in the time ahead.

It is difficult to establish with certainty what a correct treatment level is. The mean treatment rate in Norway is not necessarily the correct level, but it can be assumed that the correct level lies closer to this mean than to the extremes. Therefore it will probably be possible to raise the quality of treatment most by adjusting the levels for patients in the catchment areas with lowest and highest consumption towards the national mean. Such a harmonisation of practice, which we see in the last year of the period 2009–2014, will probably mean higher quality for the patient population as a whole.

This study does not evaluate patients' experience of the treatment they have received. Fifty-eight per cent of all complaints to the Norwegian System of Patient Injury Compensation end in rejections [\(15, 16\)](#). This indicates that there are large differences between patients' expectations of the outcome of their treatment, and the actual outcome. Patients should be involved to a greater extent in the decision concerning treatment, and encouraged to make choices that are more in line with their preferences [\(31\)](#).

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