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Main health-related quality-of-life issues in patients after a distal radius fracture

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Abstract: A i m. The aim of this study was to identify and assess the degree and clinical course of the main health-related quality-of-life (HRQoL) issues in patients after a distal radius fracture (DRF).

M a t e r i a l s a n d m e t h o d s. Patients were eligible if they were between 18–80 years and were within 1–3 days after a non-comminuted DRF. All patients filled out the Polish version of the IOF QLQ, the SF-36 and a demographic questionnaire. Assessment points were set as soon as possible after the fracture, 7 days, 6 weeks, 3 months, and 6 after the fracture. Standard statistical analyses were performed.

R e s u l t s. During the 16 month recruitment period a total of 71 patients (55 women — 77.5%), with a mean age of 64.1 ± 12.4 years, were included in the study group. All patients suffered from Colles type fractures. Attrition to follow-up was acceptable. At baseline, basing on the IOF QLQ scale scores, DRF patients had the most significant problems with physical function (82.8/100; with 100 representing the worst possible HRQoL), and general health (78.1/100). Basing on SF-36 scale scores patients most significant problems were associated with role limitations due to physical health problems (15.1/100; with 100 representing the best possible HRQoL), and bodily pain (39.5/100).

C o n c l u s i o n s. Concluding, this study shows that the main issues with which patients with and extra-articular DRF struggle the most are pain of the fractured extremity and physical dysfunction. These symptoms are most pronounced in the early post-injury period, and in the majority of patients steadily decrease over a period of six months.

Key words: distal radius fracture; health-related quality-of-life; IOF QLQ; SF-36; wrist.

Introduction

Distal radius fractures (DRF) are one of the most commonly seen in clinical practice and account for 17% of all fractures diagnosed [1]. In the USA the prevalence of DRFs is estimated to exceed 600 000 per year [2]. One can easily distinguish two age groups who are most prone to sustain a DRF — young males (typically 5–24 years of age; high energy fractures) or the elderly (65 years and above), as the distal radius is a frequent site of osteoporotic fractures occurring about 15 years earlier in life than other osteoporotic fractures like hip fractures [3, 4]. More than 60% of DRFs are displaced and require reduction, and though extra-articular DRFs are considered to be relatively harmless, inadequate treatment may result in severely impaired wrist function [5].

DRF causes both short-term [6] and long-term limitations [7]. The first ones include decreased grip strength, forearm, and wrist motions, and are seen after cast removal or in the acute postoperative period [6]. Long-term limitations can be seen even after 10 years following the initial injury, with patients reporting pain and reduced function of the wrist and hand during heavier tasks [7]. The above-mentioned factors have a complex impact on quality-of-life (QoL), which in this case is a derivative of how much patients are actually bothered by or satisfied with their own levels of functioning [8]. Patient's satisfaction may influence the accompanying health care consumption and consequently health care costs [8].

QoL focuses on patients' subjective evaluation of physical, psychological and social aspects of their well-being [8]. QoL comprises both health-related quality-of-life (HRQoL) which focuses on QoL aspects impacted by a certain disease, and global quality of life (GQoL) reflecting an individuals' satisfaction with life, and has a meaning beyond an individuals' health [9].

There are several tools available to assess recovery after a DRF — specific for wrist fracture (eg. patient-rated wrist evaluation — PRWE), the whole upper extremity (eg. disability of the arm, shoulder and hand questionnaire — DASH and its abbreviated version — quick-DASH) or generic questionnaires such as the short form 36 (SF-36) or the EQ-5D [10, 11].

To understand the problems associated with HRQoL decrease in DRF patients one has to use an appropriate tool, which will allow to detect such changes. In this case we have decided to use both a generic HRQoL instrument — the SF-36 [12], and a DRF specific tool — the International Osteoporosis Foundation quality of life questionnaire for patients with wrist fracture (IOF QLQ) [10]. Such a combination will allow to capture both general, as well as specific HRQoL issues troubling DRF patients.

Thus, the aim of this study was to identify and assess the degree and clinical course of the main HRQoL issues in patients after a DRF.

Materials and methods

Patients, for this prospective study, were recruited between January 2013 and April 2014, in two hospitals in Krakow (Poland).

The study group comprised patients with a recent DRF (treated surgically or non-surgically). Eligibility criteria included being between 18 and below 80 years of age, and being within 1–3 days after a DRF. Exclusion criteria were lack of consent to participate in the

study, inability to understand or complete the questionnaires, reoperation or remanipulation of the fracture, comminuted or pathological fractures, patients after polytrauma or patients with diseases having a severe impact on HRQoL (eg. cancer).

Interview and examination procedure

The patients were approached during their visits at the outpatient clinics of the participating centers or during their stay at the clinic, and informed about the study. The interview and examination only took place after written informed consent was obtained. The whole procedure was performed by medical doctors.

Baseline patient characteristics were gathered using a personal questionnaire. These included gender, age, date, side (left/right, dominant/non-dominant), type of fracture and type of treatment (surgical or non-surgical — closed reduction and casting). Next the examining clinician, using the modified Gartland and Werley score [13], assessed wrist and hand function of both upper limbs. After this, the patient was asked to fill in the IOF QLQ and the SF-36.

Each patient was first examined as soon as possible after the fracture (usually at the same day the fracture occurred or during the next 24 hours). Next the patients were reexamined during each control visit at 7 days, 6 weeks, 3 and 6 months post fracture.

The SF-36 Health Survey

The SF-36 Health Survey is composed of 36 questions and standardized response choices, organized into eight multi-item scales: physical functioning (PF), role limitations due to physical health problems (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and general mental health (MH). All raw scale scores are linearly converted to a 0 to 100 scale, with higher scores indicating higher levels of functioning or well-being. In this study we have used the pretranslated Polish version of the SF-36 [12].

The IOF quality of life questionnaire for patients with wrist fracture

The IOF QLQ is composed of 12 questions scored on a 1 to 5 Likert scale. The questions form four domains — pain (question no. 1), upper limb symptoms (questions no. 2–4), physical function (questions no. 5–11), and general health (question no. 12). The scores on individual questions were summed up to form an overall score ranging from 12 to 60. This was later recalculated by linear transformation of raw scores into a score from 0 to 100, with 0 representing the best possible HRQoL [10, 13].

The modified Gartland and Werley score

The version used in this study follows the modification of Chun and Palmer [14]. It is filled out by a medical doctor after completing patient physical examination, and allows to assess wrist pain, function, motion, grip strength, fracture union, post-operative ulnar variance

and whether any post-operative complications have occurred. The minimum score is 27.5, and the maximum possible to obtain is 100 (representing best possible wrist function). Depending on the number of points scored the outcome is classified as excellent, good or poor.

Statistical analysis

Statistical analysis was conducted using GraphPad Prism 5. To analyze the data elements of descriptive statistics were used (mean, standard deviation, percentage distribution).

Group comparison was used to assess the differences in HRQoL issues between known groups [15, 16]. Known groups used in this study were: gender (female vs. male), age (below vs. above or equal to 60 years of age), treatment type (surgical vs. non-surgical), and hand dominance (fracture of the dominant hand vs. fracture of the non-dominant extremity). Differences between groups were tested with the Student's t-test or the Mann-Whitney U-test as appropriate.

Changes of patient's HRQoL over time were assessed by comparing SF-36 and IOF QLQ scores at different time points of the study (baseline vs. 7 days, 6 weeks, 3 months, and 6 months) using the Students' t-test.

The significance level was set at $p < 0.05$.

Ethics

The research protocol was approved by the Jagiellonian University Bioethics Committee. The study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Written, informed consent was obtained from every participant before beginning the interview.

Results

Patient characteristics

During the 16 month recruitment period a total of 71 patients (55 women — 77.5%), with a mean age of 64.1 ± 12.4 years, agreed to take part in the study and were included in the study group. All patients suffered from Colles type fractures. Thirty-three (46.5%) patients suffered from a DRF of the right extremity, and 38 (53.5%) from a DRF of the left extremity. There were 35 (49.3%) fractures of the dominant, and 36 (50.7%) DRF's of the non-dominant extremity. Twenty-four (33.8%) patients underwent surgical treatment (open reduction and volar plating), and 47 (66.2%) non-surgical treatment (closed reduction and casting). Attrition to follow-up was acceptable — at baseline 71 patients took part in the study (100%), at 7 days post-inclusion 71 patients (100%), at 6 weeks 67 patients (94.4%), at 3 months 60 (84.5%), and at 6 months 60 patients still took part in the study (84.5%).

Main HRQoL issues in patients after a DRF

Taking into account the whole patient group, and basing on IOF-QLQ scale scores, at baseline DRF patients had the most significant problems with physical function (82.8/100;

with 100 representing the worst possible HRQoL), and general health (78.1/100). Basing on SF-36 scale scores patients most significant problems were associated with role limitations due to physical health problems (15.1/100; with 100 representing the best possible HRQoL), and bodily pain (39.5/100). Table 1 presents IOF QLQ, SF-36, and Gartland & Werley score changes over time.

Table 1. The IOF QLQ, the SF-36, and the Gartland & Werley score changes over time.

Scale/ Domain	Baseline n = 71	7 days n = 71	6 weeks n = 67	3 months n = 60	6 months n = 60
IOF-QLQ					
Pain	69.7 (9.2)	58.1 (11.5) p <0.0001	22.0 (7.4) p <0.0001	14.6 (10.1) p <0.0001	10.4 (6.7) p <0.0001
Upper limb symptoms	44.7 (14.0)	51.3 (13.6) p = 0.001	30.1 (10.7) p <0.0001	21.4 (9.2) p <0.0001	14.4 (11.5) p <0.0001
Physical function	82.8 (9.0)	81.3 (11.6) p = 0.55	58.9 (15.2) p <0.0001	33.1 (7.0) p <0.0001	16.6 (13.4) p <0.0001
General health	78.1 (13.7)	83.1 (9.9) p = 0.004	60.8 (12.2) p <0.0001	37.2 (18.6) p <0.0001	20.7 (11.3) p <0.0001
Overall score	67.4 (10.2)	65.9 (11.0) p = 0.33	48.3 (10.8) p <0.0001	27.8 (9.7) p <0.0001	16.1 (12.0) p <0.0001
SF-36					
PF	59.7 (23.6)	57.1 (24.0) p = 0.45	66.4 (27.2) p = 0.07	73.6 (23.5) p = 0.0001	77.3 (20.1) p <0.0001
RP	15.1 (29.0)	27.4 (28.6) p = 0.003	38.0 (25.3) p <0.0001	52.8 (21.2) p <0.0001	59.3 (19.2) p <0.0001
BP	39.5 (27.1)	42.7 (24.1) p = 0.39	79.3 (19.3) p <0.0001	79.8 (18.5) p <0.0001	84.7 (17.2) p <0.0001
GH	63.5 (14.2)	65.2 (15.7) p = 0.43	74.1 (21.3) p = 0.0001	73.2 (20.2) p = 0.0002	75.7 (18.2) p <0.0001
VT	55.3 (16.9)	61.3 (26.2) p = 0.06	68.6 (20.4) p <0.0001	71.0 (15.4) p <0.0001	72.6 (13.1) p <0.0001
SF	51.7 (13.3)	51.4 (18.5) p = 0.90	69.2 (24.8) p <0.0001	80.3 (22.5) p <0.0001	88.1 (17.0) p <0.0001
RE	40.8 (17.0)	47.3 (20.6) p = 0.02	74.8 (17.6) p <0.0001	83.4 (16.4) p <0.0001	86.2 (19.8) p <0.0001
MH	67.4 (24.1)	70.3 (22.2) p = 0.39	78.8 (19.7) p = 0.0005	84.1 (16.4) p <0.0001	82.0 (17.9) p <0.0001
Gartland & Werley score					
Excellent (%)	–	–	–	38,3%	41.7%
Good (%)	–	–	–	36.7%	38.3%
Poor (%)	–	–	–	25.0%	20.0%

Data presented as mean values \pm (SD) and p values comparing baseline and specific time point scores.

SD – standard deviation; n – number; PF – physical functioning; RP – role limitations due to physical health problems; BP – bodily pain; GH – general health perceptions; VT – vitality; SF – social functioning; RE – role limitations due to emotional problems; MH – general mental health.

Group comparison

Tables 2 and 3 present group comparison by gender (male vs. female), age (below vs. above or equal to 60 years of age), treatment type (surgical vs. non-surgical), and fracture side (fracture of the dominant hand vs. fracture of the non-dominant extremity), at the 7th day post injury.

Table 2. Mean scale scores at 7 days post injury — gender and age related differences.

Scale/Domain	Males (n = 16)	Females (n = 55)	p-value (males vs. females)	Age <60 (n = 35)	Age ≥60 (n = 36)	p-value (age <60 vs. age ≥60)
IOF-QLQ						
Pain	53.3 (11.5)	59.5 (9.7)	0.04	61.7 (14.3)	56.1 (12.8)	0.09
Upper limb symptoms	48.2 (9.4)	52.2 (7.2)	0.07	52.1 (10.7)	50.9 (16.7)	0.72
Physical function	82.3 (13.1)	81.0 (10.2)	0.68	75.7 (9.6)	84.3 (21.7)	0.04
General health	87.2 (10.7)	81.9 (14.0)	0.17	75.9 (13.8)	87.0 (19.2)	0.007
Overall score	67.1 (9.3)	65.9 (7.5)	0.60	62.7 (7.1)	70.6 (11.3)	0.0008
SF-36						
PF	54.7 (12.9)	57.8 (9.9)	0.31	62.0 (13.7)	54.4 (11.9)	0.02
RP	31.5 (7.6)	26.2 (8.5)	0.03	22.1 (10.4)	30.3 (7.4)	0.0003
BP	49.6 (12.7)	40.7 (11.6)	0.01	39.5 (14.1)	44.4 (12.0)	0.12
GH	59.0 (11.4)	67.0 (13.4)	0.03	71.4 (15.0)	61.8 (13.8)	0.007
VT	64.1 (9.1)	60.5 (10.1)	0.20	76.9 (11.6)	52.8 (10.1)	>0.0001
SF	53.8 (13.7)	50.7 (11.1)	0.36	55.9 (12.2)	49.0 (16.7)	0.05
RE	55.9 (10.0)	44.8 (7.9)	>0.0001	49.1 (9.3)	46.3 (11.5)	0.26
MH	75.1 (7.2)	68.9 (10.8)	0.04	78.3 (8.5)	66.0 (8.6)	>0.0001

Data presented as mean values ± (SD) and p values comparing baseline and specific time point scores. Statistically significant differences are marked in bold.

SD — standard deviation; n — number; PF — physical functioning; RP — role limitations due to physical health problems; BP — bodily pain; GH — general health perceptions; VT — vitality; SF — social functioning; RE — role limitations due to emotional problems; MH — general mental health.

Table 3. Mean scale scores at 7 days post injury — treatment type and fracture side related differences.

Scale/ Domain	Dominant hand DRF (n = 35)	Non-dominant hand DRF (n = 36)	p-value (dominant vs. non-dominant hand DRF)	Surgical treatment (n = 24)	Non-surgical treatment (n = 47)	p-value (surgical vs. non-surgical treatment)
IOF-QLQ						
Pain	60.3 (9.2)	56.0 (10.4)	0.07	60.9 (15.2)	56.7 (10.4)	0.18
Upper limb symptoms	50.7 (6.5)	51.9 (8.8)	0.52	55.3 (11.8)	49.3 (10.3)	0.03
Physical function	92.4 (15.4)	70.5 (14.1)	>0.0001	71.9 (9.6)	86.1 (13.2)	>0.0001
General health	87.4 (12.3)	78.9 (13.7)	0.008	82.5 (7.0)	83.4 (7.9)	0.64

Overall score	70.8 (11.0)	64.1 (12.9)	0.02	61.2 (10.5)	68.3 (11.2)	0.01
SF-36						
PF	49.3 (14.1)	64.7 (9.8)	>0.0001	63.4 (9.3)	53.9 (10.4)	0.0003
RP	15.9 (21.3)	38.6 (16.3)	>0.0001	31.2 (13.7)	25.5 (14.4)	0.11
BP	44.0 (11.1)	41.4 (12.7)	0.36	45.0 (12.5)	41.5 (13.1)	0.28
GH	63.6 (13.1)	66.8 (10.6)	0.26	64.2 (7.2)	65.7 (8.0)	0.44
VT	61.5 (7.3)	61.1 (8.1)	0.83	63.0 (8.8)	60.4 (9.3)	0.26
SF	42.3 (12.0)	60.3 (11.3)	>0.0001	49.9 (10.0)	52.2 (13.7)	0.47
RE	46.1 (8.5)	48.5 (9.9)	0.28	57.3 (11.6)	42.2 (8.7)	>0.0001
MH	66.8 (6.1)	73.7 (8.3)	0.0002	73.7 (9.5)	68.6 (11.2)	0.06

Data presented as mean values \pm (SD) and p values comparing baseline and specific time point scores. Statistically significant differences are marked in bold.

SD — standard deviation; n — number; DRF — distal radius fracture; PF — physical functioning; RP — role limitations due to physical health problems; BP — bodily pain; GH — general health perceptions; VT — vitality; SF — social functioning; RE — role limitations due to emotional problems; MH — general mental health.

Figure 1 presents IOF QLQ overall score changes over time in relation to known groups analyzed.

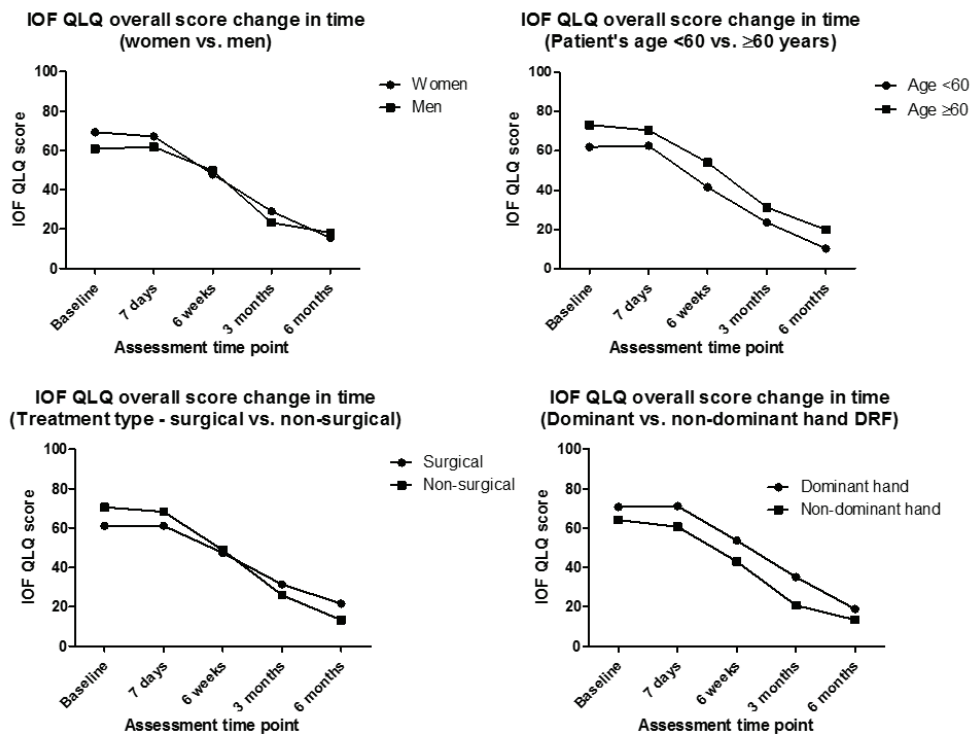


Fig. 1. IOF QLQ overall score changes over time in relation to known groups analyzed. IOF QLQ — International Osteoporosis Foundation quality of life questionnaire; DRF — distal radius fracture.

Discussion

This manuscript reports on the main HRQoL issues of patients after a DRF. The current prospective study points out some important gender, age, treatment, and fracture side related differences, as well as presents the natural course of symptoms associated with DRF over a 6-month period.

Patients after a DRF usually suffer from long-term functional impairments which restrict their daily activities [7]. Furthermore, several factors can additionally hamper patient recovery after DRF, such as carpal tunnel syndrome, complex regional pain syndrome, malalignment, post-injury arthritis etc. [8, 17]. Thus, it is important to include HRQoL assessment in pair with wrist function evaluation to be able to choose the most suitable acute medical interventions or long-term treatment modalities [8]. Prospective monitoring of HRQoL, as well as health status would allow for early detection of patients at risk of adverse outcomes and to tailor care to distinct patient groups.

Both the IOF QLQ and the SF-36 pointed out that the two most significant contributors to poor HRQoL in DRF patients are pain and physical dysfunction. Understandably older patients, and patients with their dominant hand fractured reported worse physical function than their younger counterparts or patients with a DRF of their non-dominant hand. Interestingly, in opposition to what has been written regarding gastric cancer patients [18], in this study women reported suffering from greater (post-injury/post-surgery) pain than men. It is difficult to find a suitable explanation for this phenomenon, as for example, laboratory studies conducted thus far on humans have showed no significant differences in pain perception among men and women [19].

There were no significant differences in the overall IOF QLQ score between genders — both men and women recovered at a similar pace, and to a similar degree at the 6 months assessment time point. Understandably also younger patients recovered faster, and did not experience symptoms as severe as patients 60 years or older. As to treatment type, this study has shown that surgical treatment (with open reduction and internal fixation using a volar plate) produces better short-term outcomes than non-surgical treatment. However, in the long term (3 and 6 month assessment periods) the questionnaires of surgically treated patients yielded similar result to non-surgical treatment (closed reduction and casting). One could speculate that long-term (one year and more) HRQoL of patients after DRF might return to the pre-injury level [20]. Once again understandably a DRF of the dominant hand caused more problems for the patients, but finally at the 6 month assessment time point reached a similar level as HRQoL of patients after a DRF of the non-dominant hand. Long-term these minor differences most probably also even out [20].

Older patients with a DRF reported worse general health (IOF QLQ and SF-36) and vitality (SF-36) than their “under 60” counterparts. This could be either caused by older age itself or by the fact that the sustained DRF aggravates preexisting health conditions. A DRF of the dominant extremity was connected with not only impaired physical function, general health, and increased role limitations but also worse social functioning and mental health. All of the above were probably caused by the fact of exclusion of these individuals from everyday life, both at home and at work. This study has also shown that in the early

post-injury/post-operative period (about 1 week post) promotes surgical treatment over non-surgical, leading to less upper limb symptoms, better physical function, and less role limitations in patients treated surgically. However, long-term these differences even out, and the choice of correct treatment that will guarantee best post-injury HRQoL still sometimes remains elusive.

We have chosen to compare mean scale scores at 7 days post injury, as the first week, which is the early post-trauma period, is characterized by a varying clinical course, which may lead to significant short-term changes in HRQoL perception among different patients. The study has demonstrated that the IOF QLQ has adequate responsiveness to change over time during a 6 month period in patients after a DRF. The rapid and significant HRQoL changes seen in the first 3 months after the fracture, stand in agreement with other similar studies [10, 11]. Seeing the results at 6 months, we could speculate that after one year after a DRF a patients' HRQoL could return to the pre-injury level. The SF-36 scores back up a similar thesis.

It is important to bear in mind that HRQoL can be both assessed in a broad spectrum — i.e. by using generic instruments, but also in a tailored way by using tools made specifically for HRQoL assessment in patients with a certain disease. The latter, if they exist for a specific condition, should be used preferentially [21, 22].

This study does carry with itself some limitations. The inclusion/exclusion criteria may have biased the HRQoL score. Patients with comminuted fracture were excluded from the study. In the mentioned patient group we could most probably expect lower scores than the ones obtained in this study. However we decided against including these patients as the clinical course of their disease may significantly vary from patients who do not suffer from a comminuted DRF, due to the complex nature of the fracture itself.

Concluding, this study shows that the main issues with which patients with and extra-articular DRF struggle the most are pain of the fractured extremity and physical dysfunction. These symptoms are most pronounced in the early post-injury period, and in the majority of patients steadily decrease over a period of six months. We could speculate that at one year post-injury, most patients would have returned to their pre-injury HRQoL level.

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Conflict of interest

None declared.

References

1. *Singer B.R., McLauchlan G.J., Robinson C.M., Christie J.*: Epidemiology of fractures in 15,000 adults: the influence of age and gender. *J Bone Joint Surg Br.* 1998; 80: 243–248.
2. *Chung K.C., Spilson S.V.*: The frequency and epidemiology of hand and forearm fractures in the United States. *J Hand Surg Am.* 2001; 26: 908–915.

3. Cummings S.R., Melton L.J.: Epidemiology and outcomes of osteoporotic fractures. *Lancet*. 2002; 359: 1761–1767.
4. Mallmin H., Ljunghall S., Persson I., Naessén T., Krusemo U.B., Bergström R.: Fracture of the distal forearm as a forecaster of subsequent hip fracture: a population-based cohort study with 24 years of follow-up. *Calcif Tissue Int*. 1993; 52: 269–272.
5. Villar R.N., Marsh D., Rushton N., Greatorex R.A.: Three years after Colles' fracture. A prospective review. *J Bone Joint Surg Br*. 1987; 69: 635–638.
6. Byl N.N., Kohlhasse W., Engel G.: Functional limitation immediately after cast immobilization and closed reduction of distal radius fractures: Preliminary report. *J Hand Ther*. 1999; 12: 201–211.
7. Foldhazy Z., Tornkvist H., Elmstedt E., Andersson G., Hagsten B., Ahrengart L.: Long-term outcome of nonsurgically treated distal radius fractures. *J Hand Surg*. 2007; 32 (9): 1374–1384.
8. Van Son M.A., De Vries J., Roukema J.A., Den Ouden B.L.: Health status and (health-related) quality of life during the recovery of distal radius fractures: a systematic review. *Qual Life Res*. 2013; 22: 2399–2416.
9. Burckhardt C.S., Anderson K.L.: The Quality of Life Scale (QOLS): reliability, validity, and utilization. *Health Qual Life Outcomes*. 2003; 1: 60.
10. Lips P., Jameson K., Bianchi M.L., et al.: Validation of the IOF quality of life questionnaire for patients with wrist fracture. *Osteoporos Int*. 2010; 21: 61–70.
11. MacDermid J.C., Richards R.S., Donner A., Bellamy N., Roth J.H.: Responsiveness of the SF-36, disability of the arm, shoulder, and hand questionnaire, patient-rated wrist evaluation, and physical impairment measurements in evaluating recovery after a distal radius fracture. *J Hand Surg*. 2000; 25: 330–340.
12. Tylka J., Piotrowicz R.: Quality of life SF-36 questionnaire — the Polish version. *Kardiol Pol*. 2009; 67: 1166–1169. [in Polish]
13. Bonczar T., Rutowicz B., Mizia E., Depukat P., Walocha E., Pełka P., Tomaszewski K.A., Walocha J.A.: Preliminary validation of the IOF QLQ and comparison with the SF-36 in patients after a distal radius fracture. *Folia Med Cracov*. 2014; 54 (4):35–44.
14. Chun S., Palmer A.K.: The ulnar impaction syndrome: follow-up of ulnar shortening osteotomy. *J Hand Surg Am*. 1993; 18: 46–53.
15. Püsküllüoğlu M., Tomaszewski K.A., Bottomley A., et al.: Validation of the Polish version of the EORTC QLQ-BM22 module for the assessment of health-related quality of life in patients with bone metastases. *Qual Life Res*. 2014; 23: 527–532.
16. Paradowska D., Tomaszewski K.A., Bałajewicz-Nowak M., et al.: Validation of the Polish version of the EORTC QLQ-CX24 module for the assessment of health-related quality of life in women with cervical cancer. *Eur J Cancer Care (Engl)*. 2014; 23: 214–220.
17. Grewal R., MacDermid J.C.: The risk of adverse outcomes in extra-articular distal radius fractures is increased with malalignment in patients of all ages but mitigated in older patients. *J Hand Surg*. 2007; 32: 962–970.
18. Tomaszewski K.A., Püsküllüoğlu M., Biesiada K., et al.: Main influencing factors and health-related quality of life issues in patients with oesophago-gastric cancer — as measured by EORTC tools. *Contemp Oncol (Pozn)*. 2013; 17: 311–316.
19. Racine M., Tousignant-Laflamme Y., Kloda L.A., Dion D., Dupuis G., Choiniere M.A.: Systematic literature review of 10 years of research on sex/gender and experimental pain perception — Part 1: Are there really differences between women and men? *Pain*. 2012; 153: 602–618.
20. Wilcke M.K., Abbaszadegan H., Adolphson P.Y.: Wrist function recovers more rapidly after volar locked plating than after external fixation but the outcomes are similar after 1 year. *Acta Orthopaedica*. 2011; 82: 76–81.
21. Wrażeń W., Golec E.B., Tomaszewska I.M., Walocha E., Dudkiewicz Z., Tomaszewski K.A.: Preliminary psychometric validation of the Polish version of the EORTC Elderly module (QLQ-ELD14). *Folia Med Cracov*. 2014; 54 (2): 35–45.
22. Tomaszewska I.M., Głowacki R., Paradowska D., Walocha E.: Preliminary psychometric validation of the Polish version of the EORTC Head and Neck module (QLQ-H&N35). *Folia Med Cracov*. 2013; 53 (1): 55–63.