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PAIN INTENSITY SCALES COMPARISON IN PATIENT WITH ABDOMINAL PAIN

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SUMMARY

Background: *The aim of study was to explore efficiency of the pain rating scales on patients experiencing abdominal pain, determine correlation between the scales and their applicability to general population and determine the minimal clinical important difference in mm on the VAS as discriminatory for difference in pain intensity.*

Subjects and methods: *The study was performed at the Emergency Department of the University Clinical Hospital of Mostar on patients with abdominal pain which started less than 24 hours before, excluding patients under 16 years old, uncooperative patients and those with altered state of consciousness. The sample data were collected from February to May 2010. Hundred patients completed the questionnaire. Two patients, admitted to the Abdominal Surgery Department, were excluded. The patients were asked to sign the informed consent form and assess the level of pain on three scales (VAS, NRS, VRS).*

Results: *The NRS showed a significant difference in assessing the pain intensity in the observed time. By lapse of time, the patients were reporting lower pain intensity (P=0.017). VAS and NRS had high correlation coefficient values, indicating strong correlation and credibility. The NRS showed strong results correlation (r=0.784; P<0.001). Inter-scale correlation was growing over time. Correlation between VAS and NRS was very strong, the strongest in the last measurement (r=0.950; P<0.001). The NRS correlation with VRS (r=0.430; P<0.001) was slightly better than with VAS (r=0.402; P<0.001). The NRS proved to be the most sensitive to changes in pain intensity (SRM=0.305), whereas the VRS showed extremely low responsiveness (SRM=0.185).*

Conclusion: *Having proved as the most useful, reliable and efficient pain assessment instrument, the NRS is hereby recommended as method of pain objectification and determining changes in pain intensity.*

Key words: *abdominal pain - pain scale - comparison of scales*

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INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or is conditioned by these damage or injury (Merskey 1991). As acute abdominal pain we define the pain that occurred 24 hours before the arrival to the doctor. Acute abdominal pain is a protective mechanism of the organism which has a limited time, and stops after the rehabilitation of injury or damage. Abdominal pain is 5-10% of the problems of emergency medicine physicians, and approximately 1% of cases the reason for the admission of patients. Actions and decisions of doctors should be primarily directed to answering the question whether such a patient urgent surgical intervention or not.

In addition, it is necessary as soon as possible to determine the appropriate treatment of pain. Knowledge of the typical localization of the pain of certain pathological processes, the way and appearance of typical clinical signs greatly facilitate the diagnostic process and treatment decisions (Zabavnik 2010).

In determining the severity of pain, the four most commonly used scales: visual analogue scale (VAS), a numerical scale (NRS), a verbal scale (VRS) and Wong-Baker scale (Berthier at al. 1998, Gallagher at al. 2001, Bird at al. 2001, Gallagher at al. 2002, Bailey at al. 2007.)

Comparisons VAS score with VRS and VRS charts show that there is compliance at the level of 77-99% (Moll 2003). In studies that used a VAS scale as a tool to measure the intensity of pain, for his objectifying or to analyze the performance of analgesia, VAS scale is shown as powerful weapon, especially in combination with other scales such as NRS, VRS, Wong-Baker scale and color scale.

NRS is used as a method complementary VAS scale and as an aid in the study of analgesia effect of acute and chronic conditions (Berthier at al. 1998, Gallagher at al. 2001, Bird at al. 2001, Gallagher at al. 2002, Bailey at al. 2007). Verbal scale is descriptive scale that is used for comparison of current pain with pain that the patient felt the previous survey or before analgesia (Jensen at al. 1986, Price at al. 1994, Williamson at al. 2005). Wong-Baker scale is designed especially for children, and is made up of faces with different expressions of pain, of smiling faces symbolizing a child who does not feel pain, to face with tears, symbolized by a child who feels the strongest pain (Wong 1988).

Because of small number of papers in the field of research scale, the existence of an agreement on their usefulness and the lack of methods for the rapid assessment of the strength of pain, we tried to compare the three most commonly used scale: VAS, NRS and VRS scale. There is no gold standard for measuring pain, so the credibility and reliability of scale achieved by using a "competitive credibility", which takes another potentially credible measure to assess pain as a criteria. The research is focused on testing the scale to determine the strength of the pain, to patients with acute abdominal pain, which usually requires immediate intervention. The reason for selecting exactly these patients is complex nature of pain and variations in intensity, it has provided a wide range of responses and pain intensity. Patients who were accompanied by pain intensity were in observation, and it is very important to emphasize that they did not receive analgesics, which could further interfere with research results.

Aims of this research were to examine the utility of the scale used to determine the severity of pain in patients with acute abdominal pain, determine the relationship between the individual scales with one another and their applicability to the general population, and to determine the minimal clinically significant difference in millimeters on the VAS scale that is difference in the intensity of pain.

SUBJECTS AND METHODS

The study was performed at the Emergency Department (ED) of the University Clinical Hospital of Mostar over a period of one year on 100 consecutive patients who presented to the ED with abdominal pain which had started less than 24 hours before, excluding patients under 16, uncooperative patients and those with altered state of consciousness.

All of the patients gave informed consent and patient's anonymity was preserved.

An independently created questionnaire was used in the study, including the informed consent form.

The patients were first asked to sign the informed consent form and then to assess the level of pain they were experiencing on the standardized VAS scale followed by the NRS scale with values from 0 to 10 (Bird at al. 2001, Gallagher at al. 2002, Bailey at al. 2007, Moll 2003, Jensen at al. 1986). Considering that the intensity of abdominal pain varies, the same procedure was repeated 15 and 30 minutes after the first pain assessment (Berthier at al. 1998., Gallagher at al. 2001). The patients were asked to complete the additional VRS scale after 15 and 30 minutes to confirm variations in pain intensity and nature (Berthier at al. 1998., Gallagher at al. 2001, Bird at al. 2001, Gallagher at al. 2002, Bailey at al. 2007).

The sample included 98 patients in total, where are 50 (51%) male and 48 (49%) female patients (χ^2 test=0.041; df=1; p=0.840). Average age of the patients from the sample was 43.5 (interquartile range: 40.5), where the youngest patient was 16 and the oldest 82 (Figure 1).

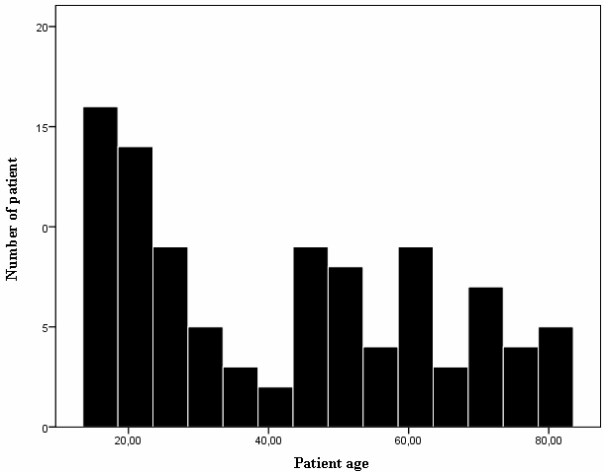

Figure 1. Patients' age

The statistical tests we used are the χ^2 test for comparison of nominal variables. To display a symmetrical distribution of continuous variables was used the arithmetic mean and standard deviation, and for asymmetric distributed median and interquartile range. Comparison of these variables was analyzed by Friedman test. We also analyzed the correlation and for this used Spearman correlation coefficient. The level of significance was set at $p < 0.05$. The obtained data were statistically analyzed software system SPSS for Windows (version 13.0, SPSS Inc., Chicago, Illinois, USA) and Microsoft Excel (Version 11 Microsoft Corporation, WA, USA).

RESULTS

Individual analysis of the pain rating scales shows that each scale measures the pain decreasing tendency over the time-interval of 0-30 minutes. Only the NRS scale displayed sensitivity to such a change in pain intensity and consequently marked it as an important change (Friedman test=8.129; p=0.017) (Table 1).

In order to check whether the applied scales could be considered reliable instruments for measuring the pain regression, scale values were put in correlation through three different time-intervals within each individual scale. The VAS scale correlated significantly with its own values through three different time-intervals. Besides, correlation relevance was decreasing together with pain regression through the three time-intervals. The NRS scale had similar results as the VAS, whereas the VRS scale did not display significant correlation in values (Table 2).

All three applied pain rating scales were put in correlation with each other in order to analyze their comparative credibility in all three different times of measurement: first pain assessment, 15 minutes after

Table 1. Pain measurement by the pain rating scales in three time-intervals

Scale	C±Q scale in 3 intervals*			Friedman test	P
	0	15	30		
VAS	4.84±(1.85)	4.70±(1.93)	4.31±(2.01)	5.549	0.062
VRS		6.02±(1.53)	5.61±(1.69)		0.059‡
NRS	5.00±(1.90)	4.91±(1.91)	4.57±(1.94)	8.129	0.017

*C=median; Q=interquartile range; ‡Wilcoxon test

Table 2. Correlation in the scales in 3 different time-intervals

Scales by time of measurement		Correlation coefficient (P value) in the groups by time of measurement		
		0 min.	15 min.	30 min.
VAS	VAS 0		0.769 (<0.001)	0.675 (<0.001)
	VAS 15	0.769 (<0.001)		0.732 (<0.001)
	VAS 30	0.675 (<0.001)	0.732 (<0.001)	
VRS	VRS 15			0.029 (0.775)
	VRS 30		0.029 (0.775)	
NRS	NRS 0			0.652(<0.001)
	NRS 15	0.784 (<0.001)		
	NRS 30		0.775(<0.001)	

Table 3. Responsiveness of scales in 3 time-intervals

Time of measurement	Scale	SRM*	SD standard deviation
0-15	VAS	0.101	1.323
	VRS		
	NRS	0.064	1.257
15-30	VAS	0.297	1.310
	VRS	0.185	1.102
	NRS	0.305	1.065

*SRM - standardised response mean

and 30 minutes after the first assessment. Correlation coefficient showed a very strong correlation between the VAS and NRS scales in all three measurements proving their comparative credibility. In addition, the analysis showed that the statistically significant correlation was increasing across time, making comparative credibility of these two scales even stronger in each subsequent pain measurement.

The VRS scale had a significant correlation with other two scales in measurement 15 minutes after the first pain measurement. However, this correlation coefficient is significantly lower compared to the one shown between the VAS and NRS scales. The correlation coefficient of the VRS scale with other two scales also displays increasing tendency of comparative credibility across time, but its value in measurement 30 minutes after the first pain measurement is still significantly lower than the correlation with the VAS and NRS scales in the same time.

Responsiveness of scales was analyzed in order to compare their validity in measuring longitudinal changes across time, the ability of the scales to detective minimal clinically important differences. The standardized response mean (SRM) of the VAS and NRS scales was increasing at approximately the same rate across time, whereas the SRM of the VRS scale was significantly weaker compared to other two scales (Table 3).

DISCUSSION

A comparative study of the usefulness of scales is the first analysis using the scales to determine the severity of pain in patients with acute abdominal pain at the emergency department. There were no statistically significant differences in gender, nor in the average age of respondents, compared to the representation of an emergency admission, the data corresponding to the results of research that dealt with the influence of gender and age on the results of testing the usefulness scales (Kelly 1998). To make scale were useful in measuring the intensity of the pain it must be shown that they are credible and reliable. Due to the lack of gold standard in measuring the severity of pain, the credibility scales is achieved by calculating the "competitive credibility". VAS, NRS and VRS have proved to be suitable, but there is no consensus on comparability of these scales or how many are powerful means of assessing pain (Ohnhauss &Adler 1975, Strong at al. 1991). Analysis of competitive credibility in this study showed a very strong correlation between VAS and NRS scale in all three periods, which proved their competitive credibility. The increase in credibility of scales as a function of time is also visible. VRS scales, also showed a statistically significant correlation with the other two measurement scales, but this

correlation coefficient is significantly lower than the coefficient of correlation between the VAS and NRS scale, and its value in the measurement after 30 minutes of the first measurement of pain remains significantly lower than the correlation of VAS and NRS scale in this period.

French multicenter comparative study of methods of measurement of acute pain in the CUM get similar results correlation between the scales. VAS and NRS are highly correlated with trauma (r=0.795) and nontraumatic (r = 0.911) patients. NRS has proven to be useful for people without trauma. Both can be used, but the NRS is appropriate for a quick assessment of pain, which is required in CUM-in (Berthier at al. 1998). Due to the existence of many scales you need to find those that meet the psychometric criteria. So we are comparing three commonly used scales wanted to explore which is the cheapest and is it possible to just one scale to assess pain, or need a synergistic effect of different scales.

Studies of outcomes treatment most commonly used one scale to measure pain before and after treatment, to assess the effect of the drug. The justification for these estimates is questionable, because of the variable nature of pain (Jensen & McFarland 1993, Salovey at al. 1993). Average pain in the short term was proposed as a more accurate and more representative measure. Individual analysis of each of the scale, it was shown that each scales measures the tendency of decrease in pain over a time period from 0 to 30 minutes. Sensitivity to the change in the level of pain and consequently the labeling of such significant changes, had a only NRS scales (P=0.017) (Table 1). There are discussion about whether the respondents can accurately remember their previous level of pain (Salovey at al. 1993, Jensen at al. 1996) and you exaggerate the severity of pain when we ask them again to assess your pain (Jamison at al.1989, Erich at al. 1985, Linton at al. 1982, Ogon at al. 1996).

Of course, it is still investigate whether it is caused by the apparent overestimation of retrospective, or is it recall bias. In a study that compares the three scales (Jennifer 2010) there is a higher level of pain before treatment, but is proven correlation greater pain before treatment and increase accountability. Recent research in which the central level is lower than the initial pain, confirming previous claim (Ogon at al. 1996, Breitbart at al. 1996).

To determine whether the observed scale, reliable instruments for measuring the withdrawal of pain, made the correlation within each scale through three periods. VAS scales significantly correlated with its values through three different periods and has seen a drop of significance correlation to the pain diminished through three periods. Similar results were achieved by the NRS scales, while scales of the VRS had a significant correlation in their values (Table 2).

The differences between the scales were found in its ability to detect changes, and their responisveness. It is evident as SRM - standardized response mean, VAS and NRS scale approximately the same growing over time, while the SRM scale VRS significantly weaker compared to the other two scales (Table 3). Although the VRS scales was used as a comparative, it has proved to be the least sensitive to detect the changes, i.e., has the lowest responsiveness (SRM = 0.185), while weak responsiveness VRS is unchanged and the VRS scale after recording of the volume scale from 0 to 10, by the model of the VAS and NRS.

These results are in accordance with the research responsibilities three most commonly used scales. The surprising result is that the largest responsiveness had NRS scales (SRM = 0.305) and greater than VAS score (SRM = 0.297), despite the opinion that your most sensitive scales for measuring changes in intensity of pain.

The limiting factors of this study are the relatively small number of subjects, short interval follow-up intensity of pain and improper format VRS scale that we used. The number of respondents was sufficient for the implementation of statistical analysis, but a larger number of respondents to offer a wider range of intensity and credibility of the results would be statistically significant. The time interval of 30 minutes is a nice option in patients with acute abdominal pain, because nearly all patients (98/100) completed by the end of the scale, they are not included pain medication which further could complicate the validity of data. Longer follow-up we achieved higher values of correlation between the scales, as shown by this study, the correlation increases over time. Having proven the usefulness and validity of scales, especially NRS scale, it would be a cheap and effective to introduce the use of scales in the daily practice of physicians and medical staff to the most effective pain assessment, and that the most rational use of analgesics. Their introduction into routine clinical practice would ensure a reliable weapon for objectifying pain, which would serve to research the effectiveness of analgesics (LoVecchio 1997).

Finally, we repeat the importance of pain as the fifth vital sign and the importance of its suppression and the most rational treatment is initiated exactly the exact evaluation of the pain. So the scales to determine the severity of pain could be useful method objectifying one such subjective categories such as pain.

CONCLUSIONS

Individual analysis of each scale, shows how each scale measures the tendency of reduction of pain over a time period from 0 to 30 minutes. VAS scale significantly correlated with its values through three different periods and has seen a drop of significance correlation to the pain diminished through three periods.

Similar results were achieved by the NRS scale, while the scale of the VRS had a significant correlation to its values.

The correlation coefficient shows a very strong correlation between VAS and NRS scale in all three periods, which proved their competitive credibility. VRS scale, also showed a statistically significant correlation with the other two measurement scales, but this correlation coefficient is significantly lower than the coefficient of correlation between the VAS and NRS scale. The correlation coefficient of the scale of the VRS on the other two levels also reflect the trend of enhancing competitive credibility over time, but its value and measurement after 30 minutes of the first measurement of pain remains significantly lower than the correlation between VAS and NRS scale in this period.

Standardized response mean (SRM) VAS and NRS scale approximately equal grows over time, while the SRM scale VRS significantly weaker compared to the other two scales.

Charts to determine severity of pain are helpful, credible assessment methods of pain in patients with acute abdominal pain. NRS scale is the most useful, most reliable and most effective method of pain assessment, therefore, is recommended as a method to objectify pain and method of detecting changes in the intensity of pain.

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Contribution of individual authors:

Zoran Trninić was responsible for the integrity of the work as a hole, he designed research topic, conception and design of the study. Manja Spahalić credited with statistical analysis, interpretation of data, provision of funding, technical support, overall supervision of the project.

Nikica Šutalo and Davorin Kozomara were responsible for data collection, statistical analysis and writing the first version of the project.

Valentina Lasić was responsible for administrative and technical support and making the work design and writing the final version of the script.

Danijel Bevanda participated in writing the final version of the script.

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