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ORIGINAL PAPER

THE PERFORMANCE OF THREE PAIN INTENSITY SCALES AND THEIR PREFERENCES AMONG CZECH WOMEN WITH ACUTE POSTOPERATIVE PAIN

Petra Mandysová[1], Zuzana Kadlečková[2]

[1]*Department of Nursing, Faculty of Health Studies, University of Pardubice, Czech Republic*
[2]*Department of Midwifery and Health and Social Work, Faculty of Health Studies, University of Pardubice, Czech Republic*

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Abstract

Aim: The first aim was to compare the performance of three pain intensity scales, the combined Visual Analogue Scale / Numerical Rating Scale (VAS/NRS), NRS, and Faces Pain Scale – Revised (FPS-R), in Czech women in the Obstetrics & Gynaecology Intensive Care Unit. The second aim was to compare the women's overall pain scale preference rankings and preference rankings by education level and age. *Design:* The design was cross-sectional. *Methods:* Seventy-four women evaluated their acute postoperative pain using the three pain scales and subsequently ranked them according to ease of responding. The data were described and analysed using descriptive statistics and the Spearman rank order correlation coefficient. *Results:* Spearman correlations ranged from 0.905 ($p < 0.001$) between the VAS/NRS and the FPS-R to 0.945 ($p < 0.001$) between the VAS/NRS and the NRS. As for overall preference, the NRS and the FPS-R were ranked first ($n = 32$; 43% in both cases). *Conclusion:* Correlations across all three scales were high. Therefore, the scales appeared equivalent. Overall, preference rankings of the NRS and FPS-R were comparable and were better than those obtained for the VAS/NRS. Therefore, both scales could be recommended for clinical use in the Czech Republic.

Keywords: pain scale, obstetrics, gynaecology, Faces Pain Scale – Revised, Numerical Rating Scale, Visual Analogue Scale.

Introduction

Pain is a ubiquitous phenomenon that accompanies a variety of conditions. Despite the inherent subjectivity of pain, assessment of pain in clinical practice can be fairly simple and straightforward if we deal with acute pain: in this case, focusing on pain intensity and location may be sufficient (Breivik et al., 2008).

Pain intensity is a quantitative estimate of the severity of perceived pain, and the most commonly used pain scales include the Verbal Rating Scale (VRS), the Visual Analogue Scale (VAS), and the Numerical Rating Scale (NRS) (Hjermstad et al., 2011). In addition, the Faces Pain Scale (FPS), which was originally developed for children, has been increasingly used in older adults (Li et al., 2007), and more recently, in adult patients with postoperative pain (Guo et al., 2015; Li et al., 2007; Van Giang et al., 2015).

Corresponding author: Petra Mandysová, Department of Nursing, Faculty of Health Studies, University of Pardubice, Průmyslová 395, Pardubice, Czech Republic, email: Petra.Mandysova@upce.cz

Additionally, the FPS may be useful when assessing pain in samples that cover a large age range or in patients who vary with respect to cognitive function (Jensen, Karoly, 2011).

Pain assessment in women – as opposed to men – may have its unique features; for example, a pain scale containing a "worst pain possible" item may produce different results in women who have had vaginal child birth (conceivably considered the worst pain possible) compared with nulliparous women (or with men), who may have different criteria for "worst possible pain" (Bourdel et al., 2014). A related question therefore is: which pain intensity pain scale is ideal to assess pain in women?

As for postoperative pain assessment in women after surgery in the field of obstetrics and gynaecology (OB/GYN), the VAS appears to be very popular. A systematic review on peripherally applied opioids for postoperative pain has revealed that all 26 studies that were identified (7 of which focused on OB/GYN surgical interventions) used the VAS to assess pain (Nielsen et al., 2015). The VAS was used to assess postoperative pain in women with benign gynaecologic disease (Eom et al., 2013) and with gynaecologic cancer (Hotujec et al., 2015). In the

Czech Republic (CR), the VAS was used in a study on pain in women after a Caesarean section (Štourač et al., 2014).

However, the VAS does have certain drawbacks. It requires the respondent to have at least a minimum level of motor abilities to use the scale, and it is more difficult to understand than other pain intensity scales among patients with compromised cognitive function or on high doses of opioid analgesics (Jensen, Karoly, 2011). Next, some patients are hesitant to use the VAS without numbers; therefore, numbers are sometimes added to facilitate its use (Price et al., 2008). Finally, the VAS contains the item "worst possible pain", which can be defined in different ways, as explained above.

Given these problems, other pain intensity scales should be considered for assessment of women's pain. The NRS in particular is quite easy to administer and score, and it can be used with a greater variety of patients (e.g. geriatric patients, patients with motor difficulties) than is possible with the VAS (Jensen, Karoly, 2011). The use of the NRS to assess pain intensity after gynaecologic surgery has been documented in the literature (Abdi et al., 2010).

Furthermore, faces pain scales (including the FPS-R) have achieved the best preference rates in several studies involving adults without cognitive impairment. However, research on the use of faces pain scales (including the FPS-R) in women recovering from OB/GYN surgery has not been identified in the available professional literature.

Aim

The first aim was to compare the performance of three pain intensity scales – the combined VAS/NRS, NRS, and FPS-R – in a study focusing on Czech women in the OB/GYN Intensive Care Unit (ICU) with acute postoperative pain. Specifically, the first aim was to examine the relationship between self-reported pain intensity using the three scales. The second aim was to compare the women's overall preference rankings and their preference rankings by their level of education and age. The ultimate aim was to make a recommendation on the most suitable scale for clinical use in these patients.

Methods

Design

This was a cross-sectional correlational study involving hospitalized female patients who were recovering from surgery in the OB/GYN ICU. A pilot study was conducted on four patients hospitalized in the study unit who volunteered to be involved. The aim of the pilot study was to test logistics of the study and to maximize clarity of instructions for the participants (the instructions were in a written form but were presented by the researcher verbally). Their data were not included in the actual study.

Sample

Purposive sampling was used. A total of 75 women were approached, of whom 1 refused to participate. Thus, the actual study involved 74 female patients (average age 47.5 ± 15.3, age range 19–80). The most common procedures were Caesarean section (13 cases), abdominal hysterectomy (12 cases), laparoscopically assisted vaginal hysterectomy (10 cases), hysteroscopy (6 cases), and transobturator tape placement (5 cases). The women were enrolled only if they were willing to collaborate and sign an informed consent. They must have been sufficiently alert to understand and communicate intelligibly with the researcher.

Data collection

Data were collected in the OB/GYN ICU of a university-affiliated hospital in a regional Czech town between May and June 2014. First, the women were asked to rate their current pain intensity using three pain-intensity scales: the combined VAS/NRS, NRS, and FPS-R. Subsequently, the women were to rank the scales according to ease of responding.

All data were collected by one member of the research team, a master-level student enrolled in an OB/GYN perioperative care study program who approached the women on the first postoperative day in the afternoon. The scales were printed on A4 paper sheet (the combined VAS/NRS in colour due to the red V-shaped scale) to ensure that the study participants could see them well.

The combined Visual Analogue Scale / Numerical Rating Scale

The combined VAS/NRS includes intensity-denoting descriptors; therefore, a Czech version of the scale was used (Hakl, Hřib, 2009). In the Czech professional literature, the scale is referred to simply as the "VAS" (Hakl, Hřib, 2009). Inherently, however, it is a combined VAS/NRS as it contains not only visual but also numerical cues for rating pain (Jensen, Karoly, 2011). Specifically, the Czech version consists of two parts: a) a black horizontal line at the bottom, which contains an-11 point scale marked 0 to 10, and b) a red V-shaped scale turned sideways, where the "closed" end of the V is located above the left end of the horizontal line and the "open" end of the V is located above the right end of

the line. In addition, two pain descriptors are located between these two graphic representations of pain: "without pain" at the left end and "pain as bad as you can imagine" at the other end (Hakl, Hřib, 2009).

The women were asked to indicate a position on the scale that represented their pain intensity. Subsequently, pain intensity was scored by measuring the distance (in centimetres) from the zero end to the patient's mark. The obtained distance was rounded to the nearest whole number.

The Numerical Rating Scale

Using the NRS involved showing the scale (a horizontal line with numbers from 0 to 10) to the women and instructing them to select the number that best reflected the intensity of their pain, with the understanding that 0 (the left endpoint) represented no pain and 10 (the right endpoint) represented the worst pain (Li et al., 2007).

The Faces Pain Scale – Revised

The FPS-R consists of 6 faces presented in a horizontal format, representing no pain to worst pain; the scale is an adaptation of an earlier version that consisted of 7 faces (Hicks et al., 2001). The Czech version of the FPS-R was obtained from the International Association for the Study of Pain (IASP) (IASP, 2014). The faces were shown without any numbers. After the patient selected the face that best represented her pain intensity, it was scored using a 0 to 10 metric (i.e., counting 0, 2, 4, 6, 8, and 10 from left to right) (IASP, 2014).

Data analysis

All data were entered into a Microsoft Excel spreadsheet. Pain scores and preference rankings were described and summarized using descriptive statistics. To analyse preference rankings, three age groups were defined in line with Erikson's Theory of Psychosocial Development: Early Adulthood (age 19–40), Middle Adulthood (age 41–65) and Older Adulthood (age > 65) (Rosdahl, Kowalski, 2008). In order to analyse preference rankings by level of education, four groups were defined based on the highest level of education attained: elementary, secondary/vocational, secondary/academic, and university.

Pain scores between two scales at a time were compared using the Spearman rank order correlation coefficient, which was computed with SPSS 21.0 statistical software (IBM SPSS, Inc., Chicago, Illinois). Similarly, the relationship between scale preference ratings and education as well as age was compared using the Spearman rank order correlation coefficient. The values for the coefficient can range from – 1 to + 1; results near ± 1 approach a perfect relationship (Kraska-Miller, 2014). If the sign of the coefficient is positive, then both variables are increasing at the same time, and if the sign is negative, then as one variable increases, the other one decreases (Kraska-Miller, 2014). Values $\geq |0.80|$ indicate a very strong association, values $\leq |0.30|$ indicate a weak association, and those between $|0.30|$ and $|0.80|$ indicate a moderate association of two variables (Kraska-Miller, 2014).

We examined whether there was a statistically significant association between a) the VAS/NRS and NRS pain scores; b) the VAS/NRS and the FPS-R pain scores; c) the NRS and the FPS-R pain scores; d) the VAS/NRS preference ranking and education level; e) the NRS preference ranking and education level; f) the FPS-R preference ranking and education level; g) the VAS/NRS preference ranking and age; h) the NRS preference ranking and age; and i) the FPS-R preference ranking and age. The significance level $\alpha = 0.01$ or 0.05 (set by default in SPSS).

Results

Middle Adulthood was the most represented age group (n = 37), followed by Early Adulthood (n = 25), and Older Adulthood (n = 12) (Table 1). The most frequent level of education was secondary/academic (n = 29), followed by university (n = 19), secondary/vocational (n = 18), and elementary (n = 8) (Table 1).

Table 1 Age groups and levels of education of the respondents (n = 74)

Level of education Age group	Elementary (n)	Secondary/ vocational (n)	Secondary/ academic (n)	University (n)	Total (n)
Early Adulthood (n)	0	5	9	11	25
Middle Adulthood (n)	5	10	15	7	37
Older Adulthood (n)	3	3	5	1	12
Total (n)	8	18	29	19	74

n – number of respondents

Comparisons of the performance of pain scales used to score individual women's pain intensity revealed that in 19 (26%) cases, women reported the same pain intensity across all three scales (i.e., regardless of the pain scale that was used); in 44 (59%) and 11 (15%) of the cases, the women reported pain intensity that varied by 1 point and 2–3 points, respectively (Table 2). Comparisons between two scales at a time revealed that in 31–37 (42–50%) of the cases, the women reported the same pain intensity, and in 33–37 (45–50%) of the cases, the women reported pain intensity that varied by 1 point. Spearman correlations were 0.945 ($p < 0.001$) between the VAS/NRS and the NRS, 0.905 ($p < 0.001$) between the VAS/NRS and the FPS-R, and 0.928 ($p < 0.001$) between the NRS and the FPS-R.

Table 2 Comparisons of the performance of pain intensity scales in individual women (n = 74)

Pain score variation (points)	All three scales n (%)	VAS/NRS vs. NRS n (%)	VAS/NRS vs. FPS-R n (%)	NRS vs. FPS-R n (%)
0	19 (26)	35 (47)	31 (42)	37 (50)
1	44 (59)	37 (50)	34 (46)	33 (45)
2	9 (12)	2 (3)	8 (11)	3 (4)
3	2 (3)	0 (0)	1 (1)	1 (1)
Total	74 (100)	74 (100)	74 (100)	74 (100)

n – number of respondents; NRS – Numerical Rating Scale; FPS-R – Faces Pain Scale – Revised; VAS/NRS – combined Visual Analogue Scale / Numerical Rating Scale

On the subject of the women's preference rankings, the VAS/NRS was placed first by 10 (14%) women, second by 17 (23%) women, and third by 47 (64%) women (Table 3). The NRS was placed first by 32 (43%) women, second by 29 (39%) women, and third by 13 (18%) women. The FPS-R was placed first by 32 (43%) women, second by 28 (38%) women, and third by 14 (19%) women.

Table 3 Preference rankings of pain intensity scales (n = 74)

Pain Scale	VAS/NRS		NRS		FPS-R	
Ranking	n (%)	Cumulative n (%)	n (%)	Cumulative n (%)	n (%)	Cumulative n (%)
1st	10 (14)	10 (14)	32 (43)	32 (43)	32 (43)	32 (43)
2nd	17 (23)	27 (36)	29 (39)	61 (82)	28 (38)	60 (81)
3rd	47 (64)	74 (100)	13 (18)	74 (100)	14 (19)	74 (100)
Total	74 (100)		74 (100)		74 (100)	

n – number of respondents; NRS – Numerical Rating Scale; FPS-R – Faces Pain Scale – Revised; VAS/NRS – combined Visual Analogue Scale / Numerical Rating Scale

The FPS-R ranked first among women with elementary (n = 7; 88%) and secondary/vocational (n = 8; 44%) education level (Table 4). The NRS ranked first among women with secondary/academic (n = 14; 48%) and university (n = 10; 53%) education level. On the other hand, the VAS/NRS was ranked 3rd by 61–66% of women across all education levels.

Spearman correlations between the preference rankings of the three scales and education levels were as follows: -0.005 ($p = 0.969$) for the VAS/NRS; -0.207 ($p = 0.077$) for the NRS; and 0.232 ($p = 0.046$) for the FPS-R.

The NRS ranked first in Early Adulthood (n = 12; 48%) and the FPS-R ranked first in Middle Adulthood (n = 17; 46%) (Table 5). The NRS and the FPS-R ranked first in Older Adulthood (n = 6; 50% in both cases). On the contrary, the VAS/NRS was ranked 3rd by 51–92% of women across all age groups.

Spearman correlations between the preference rankings of the three scales and age were as follows: 0.089 ($p = 0.452$) for the VAS/NRS; -0.011 ($p = 0.926$) for the NRS; and -0.086 ($p = 0.465$) for the FPS-R.

Discussion

Several recent studies have focused on comparing pain intensity scales in specific conditions and settings. Fauconnier et al. (2009) compared three self-report pain intensity scales – the VAS, VRS and NRS – in women presenting with acute pelvic pain to a gynaecologic emergency unit; variations of pain intensity showed very similar patterns regardless of the pain scale used. In terms of implications for practice, the authors promoted both the VAS and NRS whereas the use of the VRS was discouraged due to insufficient response categories (Fauconnier et al., 2009).

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Table 4 Preference rankings of pain intensity scales by level of education (n = 74)

Pain Scale	VAS/NRS		NRS		FPS-R	
Ranking	**n (%)**	**Cumulative n (%)**	**n (%)**	**Cumulative n (%)**	**n (%)**	**Cumulative n (%)**
			Elementary level (n = 8)			
1st	0 (0)	0 (0)	1 (13)	1 (13)	7 (88)	7 (88)
2nd	3 (38)	3 (38)	5 (63)	6 (75)	0 (0)	7 (88)
3rd	5 (63)	8 (100)	2 (25)	8 (100)	1 (13)	8 (100)
Total	8 (100)		8 (100)		8 (100)	
			Secondary/vocational level (n = 18)			
1st	3 (17)	3 (17)	7 (39)	7 (39)	8 (44)	8 (44)
2nd	4 (22)	7 (39)	7 (39)	14 (78)	7 (39)	15 (83)
3rd	11 (61)	18 (100)	4 (22)	18 (100)	3 (17)	18 (100)
Total	18 (100)		18 (100)		18 (100)	
			Secondary/academic level (n = 29)			
1st	4 (14)	4 (14)	14 (48)	14 (48)	11 (38)	11 (38)
2nd	6 (21)	10 (34)	10 (34)	24 (83)	13 (45)	24 (83)
3rd	19 (66)	29 (100)	5 (17)	29 (100)	5 (17)	29 (100)
Total	29 (100)		29 (100)		29 (100)	
			University level (n = 19)			
1st	3 (16)	3 (16)	10 (53)	10 (53)	6 (32)	6 (32)
2nd	4 (21)	7 (37)	7 (37)	17 (89)	8 (42)	14 (74)
3rd	12 (63)	19 (100)	2 (11)	19 (100)	5 (26)	19 (100)
Total	19 (100)		19 (100)		19 (100)	

n – number of respondents; NRS – Numerical Rating Scale; FPS-R – Faces Pain Scale – Revised; VAS/NRS – combined Visual Analogue Scale / Numerical Rating Scale

Table 5 Preference rankings of pain intensity scales by age (n = 74)

Pain Scale	VAS/NRS		NRS		FPS-R	
Ranking	**n (%)**	**Cumulative n (%)**	**n (%)**	**Cumulative n (%)**	**n (%)**	**Cumulative n (%)**
			Early Adulthood: Age 19–40 (n = 25)			
1st	4 (16)	4 (16)	12 (48)	12 (48)	9 (36)	9 (36)
2nd	4 (16)	8 (32)	9 (36)	21 (84)	12 (48)	21 (84)
3rd	17 (68)	25 (100)	4 (16)	25 (100)	4 (16)	25 (100)
Total	25 (100)		25 (100)		25 (100)	
			Middle Adulthood: Age 41–65 (n = 37)			
1st	6 (16)	6 (16)	14 (38)	14 (38)	17 (46)	17 (46)
2nd	12 (32)	18 (49)	14 (38)	28 (76)	11 (30)	28 (76)
3rd	19 (51)	37 (100)	9 (24)	37 (100)	9 (24)	37 (100)
Total	37 (100)		37 (100)		37 (100)	
			Older Adulthood: Age > 65 (n = 12)			
1st	0 (0)	0 (0)	6 (50)	6 (50)	6 (50)	6 (50)
2nd	1 (8)	1 (8)	6 (50)	12 (100)	5 (42)	11 (92)
3rd	11 (92)	12 (100)	0 (0)	12 (100)	1 (8)	12 (100)
Total	12 (100)		12 (100)		12 (100)	

n – number of respondents; NRS – Numerical Rating Scale; FPS-R – Faces Pain Scale – Revised; VAS/NRS – combined Visual Analogue Scale / Numerical Rating Scale

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A systematic review focusing on a comparison of the NRS, VRS, and VAS in adults found that overall, NRS and VAS scores corresponded; however, the NRS had higher compliance rates and was easier to use compared with the other two scales (Hjermstad et al., 2011). Li et al. (2007) compared four pain scales in Chinese adults undergoing surgery: the VAS, NRS, VRS, and the revised FPS (FPS-R). All four scales led to the same conclusions regarding a patient's pain intensity; however, the FPS-R emerged as the best scale with respect to preference rates (Li et al., 2007). Similarly, various versions of the FPS (including the FPS-R) were the preferred pain intensity scales in other studies including cognitively intact patients (Huang et al., 2012; Taylor, Herr, 2003). In summary, the pain scales examined in the above mentioned sources appeared equivalent. In several cases, the NRS and FPS-R were recommended for use in clinical practice, mainly due to their usability and better compliance and preference rates compared with other scales.

The results in the present study are in line with the findings of the mentioned studies although they need to be compared cautiously due to the different characteristics of the participants. In the present study, the performance of the pain scales was consistent regardless of the scale that was used in most women, and Spearman correlations between pain intensity scores were very high, ranging from 0.905 ($p < 0.001$) between the VAS/NRS and the FPS-R pain scores to 0.945 ($p < 0.001$) between the VAS/NRS and the NRS pain scores. Therefore, it can be concluded that the three scales appeared equivalent. Overall, preference rankings of the NRS and FPS-R were comparable: both were placed first or second by almost the same number of women. In stark contrast, the VAS/NRS was ranked last by most women. In view of these results, both the NRS and FPS-R scales – rather than the VAS/NRS – could be recommended for clinical use in settings and with patients comparable to those used in the present study. In the CR, this would actually represent a departure from current practice as the use of the VAS (i.e., the VAS/NRS) has been widespread, including in OB/GYN (Roztočil et al., 2011) and in various surgical disciplines (Gabrhelík, Pieran, 2012).

The FPS-R was the most preferred pain intensity scale in women with elementary and secondary/vocational levels of education; the NRS was the most preferred scale in women with secondary/academic and university levels of education. However, Spearman correlations between the preference rankings and education levels revealed a statistically significant relationship only for the FPS-R ($p = 0.046$); the association was weak (0.232). As for preference rankings by age, the NRS was preferred by young adults and the FPS-R was preferred by middle-aged adults. Preference rankings of both of these scales were identical among older adults. Spearman correlations, however, did not reveal any significant associations.

Similarly, a study comparing three pain intensity scales including the FPS-R and NRS found no significant differences in participant preference by age; however, just like in our study, preference for the FPS-R was significantly related to education level – it was preferred by patients with < 6 years of education (Li et al., 2009). However, another study comparing five pain intensity scales including the VAS, VRS, and FPS revealed that scale preference was not related to education level or age (Herr, 2004).

One could argue that our results were distorted due to the combined version of VAS/NRS (rather than an individual version); however, the combined version has actually been shown to have better preference rankings compared with the individual version (Price et al., 2008). Our selection of the combined VAS/NRS scale was partially based on this premise.

One limitation was that the size of the pilot group was fairly small ($n = 4$); however, the instructions and logistics were not complicated. In fact, the NRS and FPS-R do not contain any text at all. Besides, the FPS-R instructions, defined by the IASP (2014), cannot be altered. The second limitation was the size of the sample: while it was sufficiently large to determine unequivocally that the three scales appeared equivalent in this particular study (statistical power was excellent), the preference ranking results by the level of education and age were less convincing. Without a doubt, this was affected by the fact that some of the participant subgroups were not properly represented (e.g. no woman with elementary level of education belonged to Early Adulthood). In this particular case, increasing the sample size could have led to improved statistical power of the tests.

The study adds new facts to recent research conducted in the CR on pain intensity scales, and complements findings obtained in the paediatric population using other pain intensity scales (Chromá, Sikorová, 2015). We believe, however, that our findings are relevant for clinical practice not only locally but also internationally.

Conclusion

The study aimed to compare the performance of three pain intensity scales by examining self-reported pain intensity scores using the combined VAS/NRS, NRS,

and FPS-R in a study that involved Czech women with acute postoperative pain in the OB/GYN ICU and to determine whether they appeared equivalent. The second aim was to compare the women's overall pain scale preference rankings and preference rankings by education level and age.

The most important findings were that the pain scores across the three scales were highly correlated; thus the scales appeared equivalent. Furthermore, overall preference rankings of the NRS and FPS-R were comparable and were better than those obtained for the VAS/NRS.

The findings have possible implications for use in clinical practice in OB/GYN departments, specifically in OB/GYN ICUs that care for Czech women with acute postoperative pain: based on our study, both the NRS and FPS-R scales – rather than the VAS/NRS – could be recommended for clinical use. At the same time, further validation of the findings may be beneficial both in the CR and in other countries.

Ethical aspects and conflict of interest

The study was conducted in accordance with ethical recommendations of the Helsinki Declaration of 1964, as revised in 2008. All participants were informed of the purpose of the study and agreed to be included in the research; they expressed this agreement by signing an informed consent form. Participation was voluntary, and all data were treated as confidential. The authors declare that the study has no conflict of interest.

Author contribution

Conception and design (PM, ZK), data analysis and interpretation (PM, ZK), manuscript draft (PM), critical revision of the manuscript (PM, ZK), final version of the manuscript (PM).

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