

## Post-Cholecystectomy Pain Assessment Using Visual Analogue Scale and Numerical Rating Scale

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### Abstract

- Background** Pain defines as unpleasant sensory and emotional experience associated with actual or potential tissue damage. Postoperative pain should be assessed regularly and documented carefully as it is a significant part of postoperative care. Pain scales are useful for assessment and monitoring the effectiveness of treatment. The 100 mm visual analogue scale (VAS) and the numerical rating scale (NRS) are the most commonly used one.
- Objective** To compare between VAS and NRS for assessing post-operative pain in patients undergoing elective cholecystectomy.
- Methods** A cross-sectional study was done in Al-Imamein Al-Kadhimein Medical City from the period of 1<sup>st</sup> of October 2019 to the 1<sup>st</sup> of March 2020. Fifty patients were enrolled in this study. All underwent elective cholecystectomy. Patient consents were obtained. Pain assessment was done when patients fully recovered and asking for pain relief and then one hour after giving analgesia.
- Results** Of the 50 patients, females were 42 (84%). Laparoscopic cholecystectomy has been done for 45 (90%); 33 (66%) patients received parenteral opioid and paracetamol, the remaining 17 (34%) received only paracetamol. There were no significant correlations between most of the suggested risk factors and pain perception apart from type of medications used for pain control. There is strong correlation between NRS and VAS before and after analgesia ( $P < 0.01$ ), while no observed significant effect or relation between other demographic and surgical parameters on pain score rating.
- Conclusion** This study validated that both the NRS and the VAS are two comparable acute pain scores mostly used in practice. NRS, which is easy, less pain inducing and more user friendly in the post-operative period has a strong linear association with VAS, thus can be substituted for VAS in assessment of postoperative pain.
- Keywords** Pain, cholecystectomy, Visual analogue scale, numerical rating scale
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**List of abbreviations:** NRS = Numerical rating scale, r = Correlation coefficient, Tx = Treatment, VAS = Visual analogue scale

### Introduction

Pain is defined by the International Association for the Study of Pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" <sup>(1)</sup>.

Pain should be assessed regularly and documented carefully as it is a significant part of postoperative care according to the American Pain Society Guidelines <sup>(2)</sup>. Pain scales are useful for assessment of the severity of this noxious feeling and to monitoring response and effectiveness of analgesia, of these, Visual Analogue Scale (VAS) and Numerical Rating Scale (NRS) are the two

scores widely used for acute pain assessment. Although VAS is recognized as most appropriate one, it is relatively complex and uncomfortable compared to NRS especially in the early postoperative period as the patient have to move and to put a mark on the VAS sheet, while they only have to say a number in a few second in case of NRS <sup>(3)</sup>.

### Visual analogue scale (VAS)

It is a horizontal line (usually 100 mm long) anchored on either end by the terms "no pain" or "worst pain imaginable". The patients are asked to make a mark on the line that represent how much pain they have and the score is obtained by measuring from the low

end of the scale to patient's mark, a change of 10 for the 100 mm pain VAS would be the minimal clinically importance difference, and the VAS of 33 or less signifies acceptable pain control after surgery. The main benefit of VAS is that the score appears to have the qualities of ratio data and may be treated as such statistically. The VAS also has a large number of response categories, which mean that it is considered to be more sensitive to change in pain intensity than measures with limited number of responses, it is an analog scale formatted without numbers <sup>(4)</sup> (Figure 1).

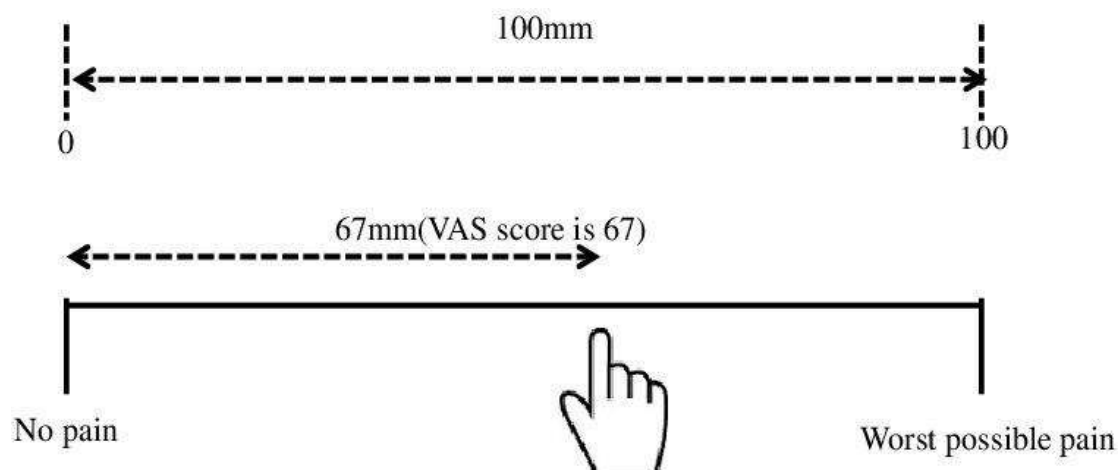


Figure 1. Visual analogue scale model

### Numerical rating scale (NRS)

In a NRS, patients are asked to circle or to say vocally the number between 0 and 10, 0 and 20 or 0 and 100 that fits best to their pain intensity. Zero usually represents 'no pain at all' whereas the upper limit represents 'the worst pain ever possible'. In contrast to the VAS, only the numbers themselves are valuable answers, meaning that there are only 11 possible answers in a 0-10, 21 in a 0-20 and 101 in a 0-100 point NRS. It thus allows only a less-subtle distinction of pain levels compared to VAS, where there are theoretically unlimited

numbers of possible answers <sup>(5)</sup>. NRS have shown high correlations with other pain-assessment tools in several studies <sup>(6)</sup>. As it is easily possible to administer NRS verbally, it can be used in telephone interviews. On the other hand, results cannot necessarily be treated as ratio data as in VAS. A change on the NRS of 20% between two time-points of an assessment is regarded as being clinically significant <sup>(7)</sup> (Figure 2).

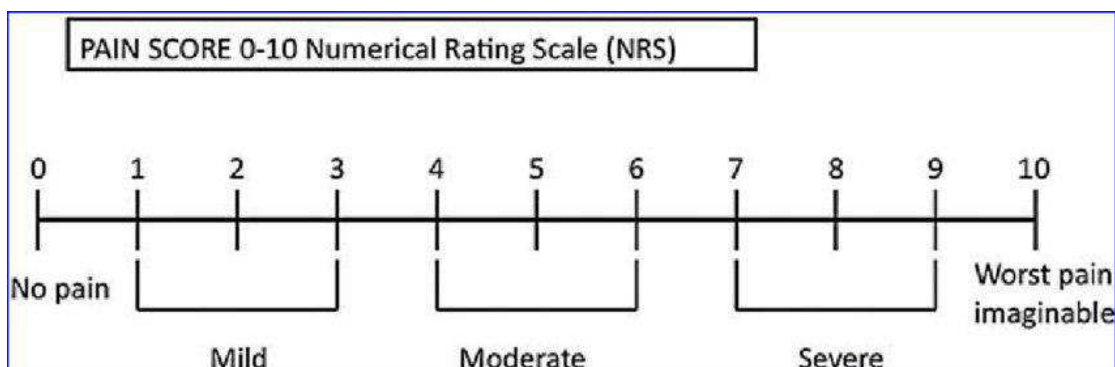


Figure 2. Numerical rating scale

This study aimed to assess postoperative pain for patients underwent cholecystectomy using VAS and NRS and the relation to age, sex, educational status, duration of surgery, use of drains, surgical procedure, type of analgesia and to compare and correlate between the two scales in assessing postoperative pain.

**Methods**

A cross-sectional study at the surgical ward of Al-Imamein Al-kadhimein Medical City from the period of 1<sup>st</sup> of October 2019 to 1<sup>st</sup> of March 2020. Fifty cases were enrolled in this study. All of them submitted to cholecystectomy. All the patients were consented verbally. Patients were excluded if they had poor language comprehension, drug and alcohol dependence, psychiatric disorder and or concurrent serious medical disorder impairing

the completion of questionnaire. Patients interviewed for pain assessment at two separate occasion using VAS and NRS within 24 hours from surgery, the first was after recovery from general anesthesia and patients start asking for pain relief, then one hour after instillation of the analgesia (Acetaminophine Paracetamol vial 1 g and /or Opioid Pethidine 100 mg) intravenously. Data was analyzed using statistical package for social sciences (SPSS) version 21

**Results**

The mean age and duration of surgery were (42.78±12.96) year, (1.1±0.5) hour respectively. The mean score for NRS before and after treatment were 8.46, 5.66, while for VAS before and after treatment were 8.28, 5.12 subsequently, as shown in table (1).

Table 1. Means of parametric data

Parameter	Mean	SD	Range
Age (yr)	42.78	12.96	22-71
Duration of operation (hr)	1.1	0.5	1-2
NRS before Rx	8.46	1.56	5-10
NRS After Rx	5.66	2.17	2-10
VAS Before Rx	8.28	1.62	4-10
VAS After Rxx	5.12	2.26	2-10

Majority of the study population were females 42 (84%). About 80% of patients have academic achievement of primary or secondary school (36%, 21%) respectively. Ninety percent of patient had their operation finished with

laparoscopic approach. Drains have been left in nearly 90% of cases. Around two third of patient have their pain being controlled by combined usage of Paracetamol and Opioid 66%, table (2).

**Table 2. Frequencies of non-parametric data**

Parameter		Frequency	Percentage
Gender	Females	42	84.0
	Males	8	16.0
Educational status	None	1	2.0
	Primary	18	36.0
	Secondary	21	42.0
	College	10	20.0
Type of surgery	Laparoscope	45	90.0
	Open	5	10.0
Drainage	Yes	44	88.0
	No	6	12.0
Post-operative drug	Opioid+Paracetamol	30	60.0
	Paracetamol	15	30.0
	Not achieved pain relief	5	10.0

There was no significant correlation between the two scores in relation to the age and

duration of surgery before and after analgesia as shown in table (3).

**Table 3. Correlation between NRS and VAS with age and duration of surgery**

Pain scale		NRS		VAS	
		Before Rx	After Rx	Before Rx	After Rx
Age (yr)	r	0.021	0.122	0.067	0.032
	p	0.883	0.321	0.643	0.621
Duration (hr)	r	0.018	0.101	0.112	0.054
	p	0.129	0.142	0.438	0.461

The relation of pain score rating and sex have been assessed, both sex have comparable pre and post analgesia results as shown in table (4). The effect of educational level on pain assessment was as follows, those with college level of education have similar score of 7.8 for (NRS and VAS) while those who have primary

educational level have (NRS 8.78) and (VAS 8.67) as shown in in table (5).

The mean of pain score was comparable in relation to the type of cholecystectomy, NRS (8.44, 8.6), and VAS (8.36, 8.6) before analgesia for laparoscopic and open surgery respectively. Also for post analgesia scores, as shown in table (6) below.

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Patients in whom drain were used have higher mean pain scores (NRS 8.39) and (VAS 8.18) in comparison without drain (NRS 7.4) and (VAS 7.0), but it was statistically insignificant as shown in table (7).

**Table 4. Effect of sex on pain assessment score**

		Females N=42 Mean±SD	Males N=8 Mean±SD	P value
NRS	Before Rx	8.45±1.48	8.5±2.0	0.950
	After Rx	5.11±1.2	5.43±1.6	0.360
VAS	Before Rx	8.38±1.61	8.75±1.67	0.348
	After Rx	5.2±1.6	5.31±1.2	0.251

**Table 5. Effect of educational status on pain assessment score**

	Primary N=18 Mean±SD	Secondary N=21 Mean±SD	College N=10 Mean±SD	P value
NRS before Rx	8.78±1.59	8.43±1.47	7.8±1.62	0.286
VAS before Rx	8.67±1.37	8.19±1.54	7.8±2.2	0.388

**Table 6. Effect of type of surgery on pain assessment score**

		Laparoscope N=45 Mean±SD	Open N=5 Mean±SD	P value
NRS	Before Rx	8.44±1.5	8.6±2.19	0.884
	After Rx	5.31±1.6	5.9±1.9	0.679
VAS	Before Rx	8.36±1.5	8.6±1.67	0.382
	After Rx	5.18±1.9	5.7±1.3	0.563

**Table 7. Effect of drain on pain assessment score**

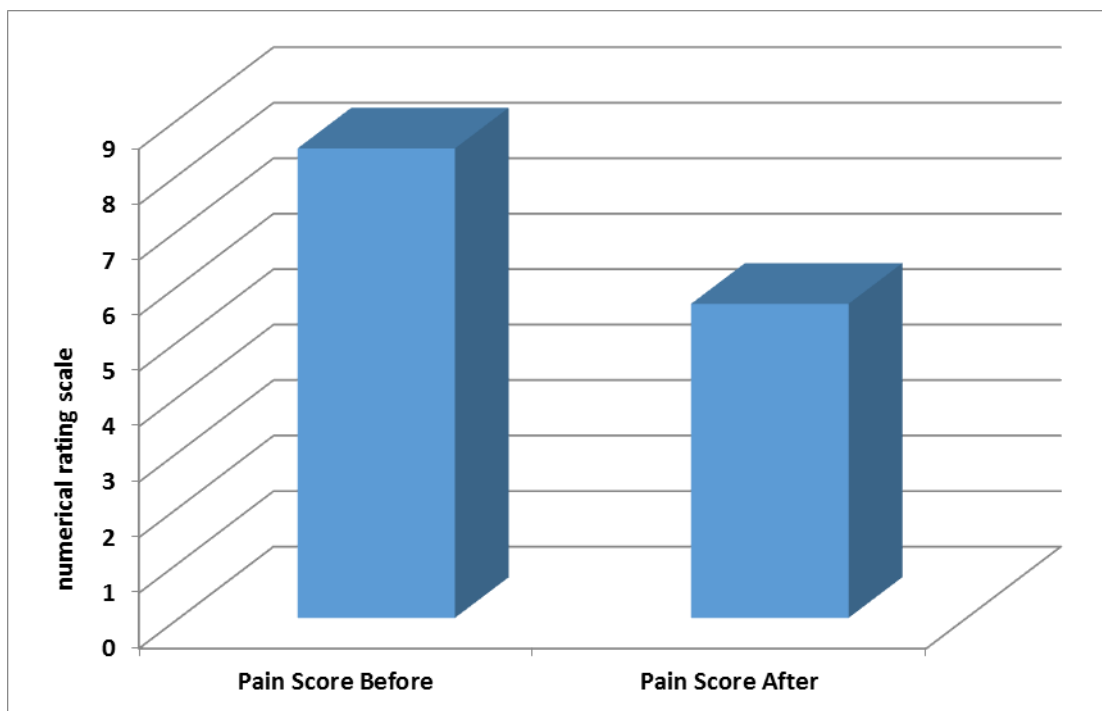
		Drain N=44 Mean±SD	No drain N=6 Mean±SD	P value
NRS before Rx		8.39±1.6	7.4±1.1	0.261
VAS before Rx		8.18±1.6	7.0±1.67	0.300

Both pain scores respond comparably to analgesia, those patients received opioid and Paracetamol 1 g vial report lower mean score (NRS 5.15, VAS 4.61) than those received Paracetamol only as shown in table (8).

Significant reduction in pain scores after analgesia were observed in both NRS and VAS (p value <0.001) as shown below (Figures 3 and 4) subsequently.

**Table 8. Effect of type of analgesia on pain assessment score**

	Opioid ± paracetamol N=33 Mean±SD	Paracetamol N=17 Mean±SD	P value
NRS after Rx	5.15±2.12	6.65±1.97	<0.01
VAS after Rx	4.61±2.09	6.12±2.29	<0.01



**Figure 3. Comparison of NRS before and after treatment by paired test**

The scatter plot drawn for the findings shows linear association between values for the two scores before analgesia. It also shows similar distribution throughout the length of the line representing the linear association,  $r = 0.581$ ,  $p$

value <0.001, accordingly there is a strong correlation between NRS and VAS (Figure 5).

Also post analgesia scattered plot test signifies a strong correlation between the NRS and VAS after treatment ( $r = 0.821$ ), ( $p$  value <0.001) (Figure 6).

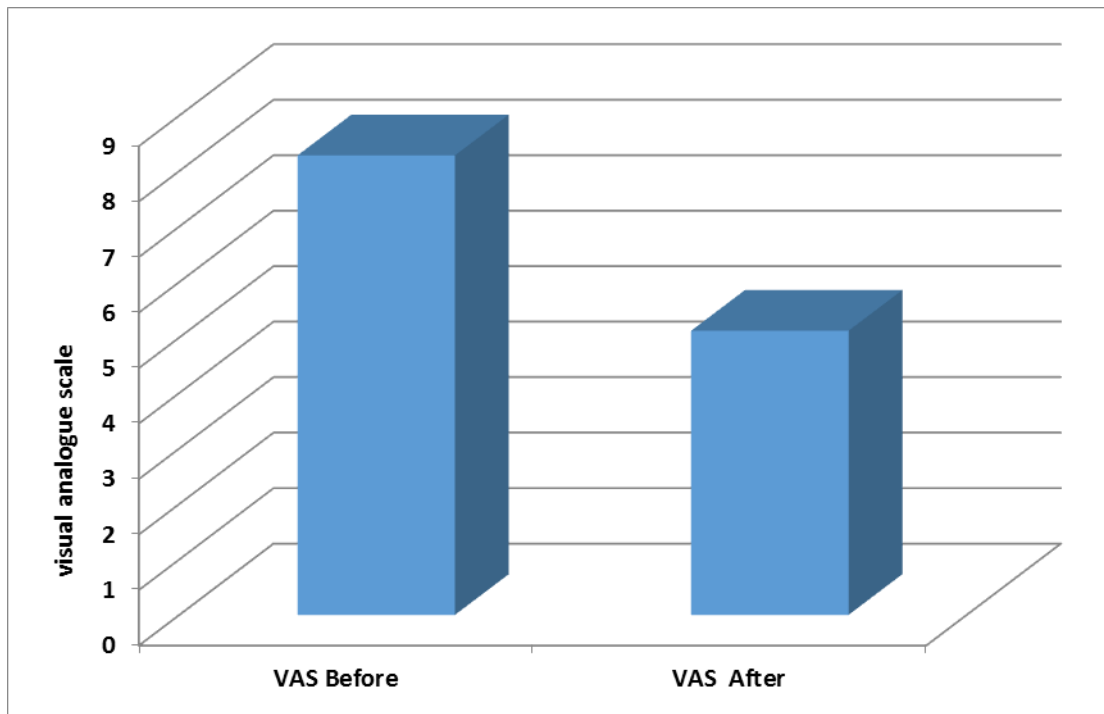
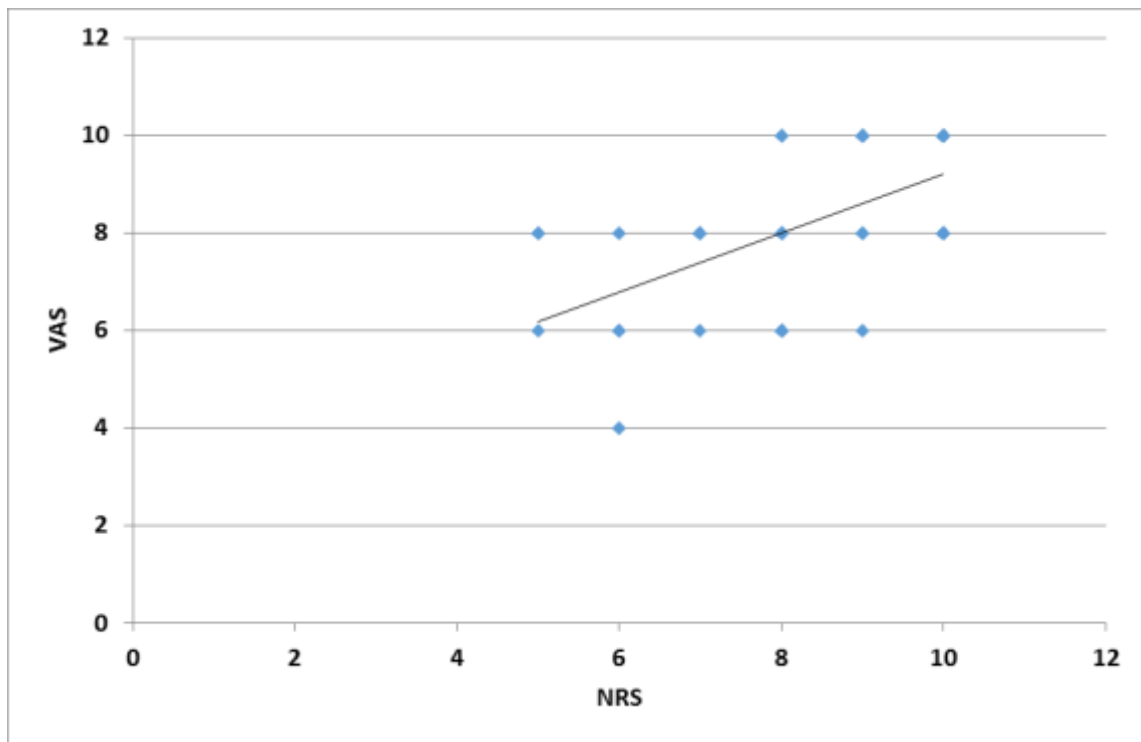
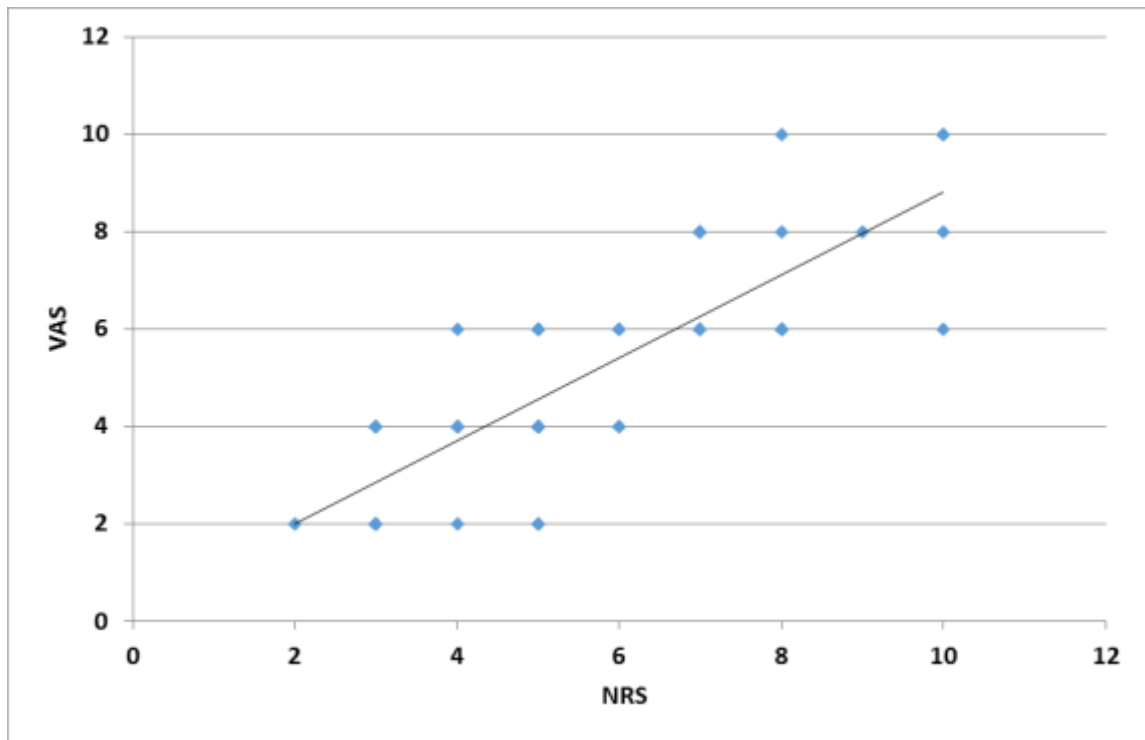


Figure 4. Comparison of VAS before and after treatment by paired test



$r = 0.581$ ,  $p \text{ value} < 0.001$

Figure 5. Correlation between numerical rating scale and visual analogue score before analgesia



$r = 0.821$ ,  $p$  value  $< 0.001$

**Figure 6. Correlation between numerical rating scale and visual analogue score after analgesia**

## Discussion

Optimal care of surgical patients mandates effective postoperative control of pain, it is an essential human right <sup>(5)</sup>. Acetaminophen (Paracetamol) is commonly used alone or in combination with opioids in the management of moderate to severe pain <sup>(8)</sup>.

Laparoscopic Cholecystectomy (LC) has become a gold standard surgical treatment of symptomatic gallstones, although LC has proven to have certain advantages and a common day case procedure, it is not of pain-free procedure <sup>(9)</sup>. Some patients after LC still experience moderate or even severe pain and may require opioid treatment. Although pain decreases with time but it is severe enough to interfere with daily activities in a substantial number of patients <sup>(10)</sup>.

In our series, the mean age of patients is 42.78 years, which is comparable to that of Khalaf et al., at Al-Basra General Hospital south of Iraq 43.5 years <sup>(11)</sup>.

The mean duration of operation in this study was 1.1 hour. A multivariate analysis done by

Lowndes et al., they found a mean operative time of 1.16 hour <sup>(12)</sup>. Neither the age nor the operative times have significant effect on pain score assessment by (NRS or VAS). In comparison with other studies shows the same results which state that there was no significant difference between age, duration of surgery and pain rating <sup>(13,14)</sup>.

## Response to analgesia

Female patients constitute majority of the study group, which is equivalent to other studies <sup>(11,15)</sup>, due to hormonal effect, still we didn't identify significant effect of gender on pain scoring, although Nguyen and Nguyen assessed post-cholecystectomy pain and they found that Females were more likely experience postoperative pain than males in Vietnam <sup>(16)</sup>, this is attributed to environmental and physical differences between two communities. Dabbagh and Ure et al., found that female patients suffer more postoperative pain than male patients, they consider sex as a

significant predictor of postoperative pain<sup>(17, 18)</sup>.

In regard to the effect of patients' education on pain perception, a higher level of education was associated with lower pain score in comparison with primary educational states, although statistically the differences were insignificant. Fadaizadeh et al., found that educational status has no significant contribution to pain score<sup>(19)</sup>.

In this series, most of the procedures completed laparoscopically, although pain perception and need for opioid was less for laparoscopic group, still no significant differences between open and laparoscopic approach in relation to pain scores. Hendolin et al., compared between laparoscopic and open cholecystectomy patients in regard to analgesic doses frequency and timing, they found that both group experience similar pain as measured by VAS in the recovery room, but the first analgesic dose was earlier in open group and need for opioid was more than laparoscopic group ( $p < 0.01$ )<sup>(20)</sup>.

Although insignificant, pain score was higher in those with postoperative abdominal drain especially at drain site. Routine drain use is still debatable, it is thought that drain will reduce pain related to CO<sub>2</sub> accumulation or prevent biloma and or hematoma. According to the Cochrane Database Systemic review randomized clinical studies by Gurusamy et al., they show no benefit of a drain<sup>(21)</sup>. Nagpal. et al., found no significant advantage of using drain after laparoscopic cholecystectomy, therefore, its routine use cannot be recommended as a means to reduce pain/nausea/ vomiting as there is higher incidence of postoperative pain and longer duration of hospital stay with its use<sup>(22)</sup>. We prefer avoidance of drain as a routine procedure unless indicated in complicated or difficult cases

Our study showed that there is positive significant association between type of analgesia and postoperative pain score, patients who received opioid and Paracetamol have lower pain score than patient who received Paracetamol only. Alimian et al., showed that although Paracetamol (1-4 g in 24

hours) is not enough for postoperative pain relief, especially in first postoperative six hours, and patients needed some doses of Meperidine (Pethidine), after eight hours the adequacy of analgesia was similar in two groups<sup>(23)</sup>. Moffat et al., and Cataldo et al., stated that Paracetamol produce 31-37% decrease in the morphine demand during the first 24 hours after surgery<sup>(24,25)</sup>.

Of the many pain scales used to assess pain worldwide, VAS, NRS and Verbal Rating Scale (VRS) are the three widely used pain scales to assess acute pain. Although they have a comparable range of accuracy, from these three scales VAS is recognized as most appropriate to assess acute pain, but is relatively complex<sup>(3)</sup>. In this series we found a strong comparable linear correlation between the two scales (VAS and NRS) for pain assessment before and after commencing analgesia as shown in figure 3 and 4 respectively. A similar result demonstrated by Gajasinghe et al., in their study, they found that the linear regression model and Pearson's correlation statistics of the VAS and NRS show stronger linear relationship between them<sup>(3)</sup>. Hjerstad et al., in their review articles show that NRS or VAS all work quite well and the most important choice is not the type of scale per se, but the conditions related to its use such as methods of administration, time frames, information related to the use of scales, interpretation of cut-offs and clinical significance, and the use of appropriate outcome measures and statistics in clinical trials, still better compliance was reported for the NRS relative to the other scales in 15 studies, whereas 16 studies did not provide any such information, lower compliance on the VAS was found in nine studies, associated with higher age, degree of trauma, or other impairments<sup>(5)</sup>.

In conclusion, NRS and VAS are two comparable acute pain scores mostly used in practice. NRS which is easy, less pain inducing and more user friendly in the post-operative period has a strong linear association with VAS, thus can be substituted for VAS in assessment of postoperative pain.

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## Conflict of interest

Author declares no conflict of interest.

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