UDC 616-009.7-056.5-089-07

S.D. Khimich[1], I.O. Malyshevskyi[2], R.M. Chornopyshchuk[1,3], O.V. Katelian[1]

The level of pain sensitivity in people with different body weight: does it have an impact on surgical operations?

[1]National Pirogov Memorial Medical University, Vinnytsya, Ukraine,
[2]Bukovynian Clinical Oncology Center, Chernivtsi, Ukraine,
[3]Pirogov Vinnytsia Regional Clinical Hospital, Ukraine

Paediatric Surgery (Ukraine). 2025. 1(86): 11-14. doi: 10.15574/PS.2025.1(86).1114

For citation: Khimich SD, Malyshevskyi IO, Chornopyshchuk RM, Katelian OV. (2025). The level of pain sensitivity in people with different body weight: does it have an impact on surgical operations?. Paediatric Surgery (Ukraine). 1(86): 11-14. doi: 10.15574/PS.2025.1(86).1114.

The aim: to determine the level of pain sensitivity in people with different body weight using our own improved algometer.

Materials and methods. The study involved 227 healthy people (110 men and 117 women) aged 19 to 78 years. The Group I consisted of 101 people with a body mass index (BMI) from 18.5 to <25.0. The Group II included 91 people with overweight and grade 1 obesity (BMI 25.0 to 35.0). The Group III included 36 patients with grade 2 (35.0 to <40.0) and grade 3 obesity (>40.0). The level of pain sensitivity was measured using a special original device.

Results. People in the Group I did not feel pain when pressing on the needle with a force of 13.3±2.6 g, the Group II – with a force of 20.5±4.0 g, and participants from the Group III – 29.8±8.2 g. The feeling of moderate pain was observed at the level of 36.6±3.4 g in the Group I, at the level of 51.7±4.0 g and 59.0±8.9 g in the Groups II and III, respectively. The severe pain in the Group I was recorded at 64.1±5.7 g; in the Group II – at 89.8±6.7 g; and in the Group III – at 101.3±13.0 g.

Conclusions. With increasing body weight and obesity, the threshold of pain sensitivity increases, i.e., with increasing obesity, people are more resistant to mechanical pain stimulation. Obese people are 1.5-2 times more resistant to mild, moderate, and severe mechanical stimulation than people with normal body weight. Reduced pain sensation in obese people may be one of the reasons for the masked development of purulent inflammatory processes of soft tissues, acute inflammatory, oncological, and destructive processes of internal organs.

The study was performed in accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Local Ethics Committee of the university. The informed consent was obtained from the patients.

The authors declare no conflict of interest.

Keywords: obesity, threshold of pain sensitivity, pain, analgesia, postoperative pain relief.

Рівень больової чутливості в людей із різною масою тіла: чи має це вплив на хірургічні втручання?

С.Д. Хіміч[1], І.О. Малишевський[2], Р.М. Чорнопищук[1,3], О.В. Кателян[1]

[1]Вінницький національний медичний університет імені М.І. Пирогова, Україна
[2]Буковинський регіональний онкологічний диспансер, м. Чернівці, Україна
[3]Вінницька обласна клінічна лікарня імені М.І. Пирогова, Україна

Мета: визначення рівня больової чутливості в людей із різною масою тіла за допомогою власного вдосконаленого алгометра.

Матеріали та методи. У дослідженні взяло участь 227 здорових людей (110 чоловіків і 117 жінок) віком від 19 до 78 років. Група I становила 101 особу з індексом маси тіла (ІМТ) від 18,5 до <25,0. Група II – 91 особу з надлишковою масою тіла та ожирінням 1 ступеню (ІМТ від 25,0 до 35,0). До групи III увійшло 36 осіб 2 ступеню (від 35,0 до <40,0) та 3 ступеню ожиріння (>40,0). Вимірювання рівня больової чутливості проводили за допомогою спеціального оригінального приладу.

Результати. Люди групи I не відчували болю при натисканні на голку із силою 13,3±2,6 г., групи II – із силою 20,5±4,0 г, а учасники з групи III – 29,8±8,2 г. Відчуття помірного болю спостерігалося на рівні 36,6±3,4 г у групі I, на рівні 51,7±4,0 г та 59,0±8,9 г у групах II та III відповідно. Відчуття сильного болю у групі I було зафіксовано на рівні 64,1±5,7 г; у групі II – на рівні 89,8±6,7 г; а у групі III – 101,3±13,0 г.

Висновки. Зі збільшенням маси тіла та ступеня ожиріння підвищується поріг больової чутливості, тобто зі збільшенням ступеня ожиріння люди більш стійкі до механічного больового подразнення. Люди з ожирінням у 1,5–2 рази більш стійкі до легкого, середнього та сильного механічного подразнення, ніж люди з нормальною масою тіла. Зниження відчуття болю в людей з ожирінням може бути однією з причин замаскованого розвитку гнійно-запальних процесів м'яких тканин, гострих запальних, онкологічних і деструктивних процесів внутрішніх органів.

Дослідження виконано згідно з принципами Гельсінської декларації. Протокол дослідження ухвалено локальним етичним комітетом університету. На проведення досліджень отримано інформовану згоду пацієнтів.

Автори заявляють про відсутність конфлікту інтересів.

Ключові слова: ожиріння, поріг больової чутливості, біль, знеболення, знеболення в післяопераційному періоді.

It is known that the problem of pain treatment has always received a lot of attention not only from anesthesiologists but also from doctors and scientists of various fields. However, the level of pain sensitivity often depends on many factors (anatomical and physiological, psychosomatic, hormonal, etc.). The question of pain sensitivity in patients with obesity is quite ambiguous. We noticed, and in 1997 we published some data, in which we indicated that in patients with increasing obesity increases the threshold of pain sensitivity, i.e., they experience less pain compared to people with normal body weight [7].

The aim of our study was to conduct a study to identify the level of pain sensitivity in people with different body weights with the help of an improved algometer.

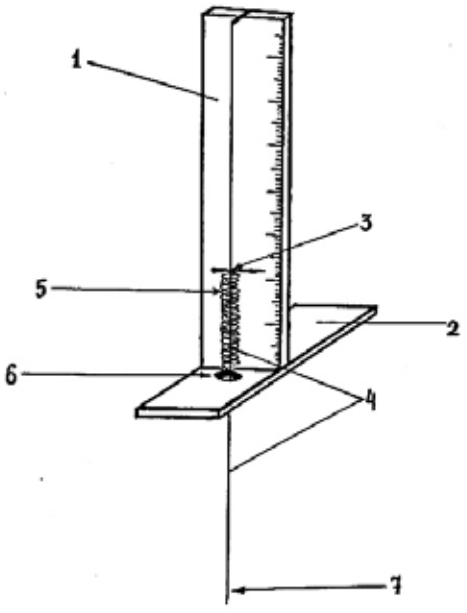

Fig. 1. Scheme of the device for measuring the degree of pain (algometer) of its design: 1 – scale, 2 – base-handle, 3 – arrow, 4 – needle, 5 – spring, 6 – hole for the needle (4) at the base of the device, 7 – the tip of the needle

Materials and methods of the study

The study involved 227 healthy people (including 110 men and 117 women) aged 19 to 78, who were explained the nature of the research and obtained informed consent to participate in the study. The study was conducted in accordance with the «WMA Declaration of Helsinki – ethical principles for medical research involving human subjects» (1964-2013) and was approved by the Committee on Bioethics of National Pirogov Memorial Medical University (Vinnytsya, Ukraine).

Body mass index (BMI) was determined by conventional methods [2]. However, in order to facilitate the perception of the results, we divided all those who participated in the study into three groups. The Group I included 101 people with normal body weight (BMI 18.5 to <25). The Group II consisted of 91 subjects with overweight and obesity class 1 (BMI from 25.0 to 35.0). The Group III included 36 people with obesity class 2 (BMI from 35 to <40) and obesity class 3 (BMI>40).

Measurements of pain sensitivity were performed using a special device of its design (algometer), the action of which was based on the principle of dosing pressure with a needle on the skin of the forearm and recording pressure (in grams) in patients. The first indicator was recorded when they did not feel pain. The second indicator is when you feel a slight pain. The third indicator was recorded when the subjects thought they were experiencing severe pain (Figures 1, 2).

The statistical methods of the study consisted of data processing, and calculation of indicators, which was carried out using packages of applied computer programs of variation and statistical analysis for data of medical and biological examinations and was carried out by the spreadsheet processor «Office Excel 2013» (product number 00216-40000-00000- AA905) and the Software Package «Statistica 6», The Student's criterion was taken into account (the indicator was considered reliable if it was equal to 95% or higher), standard deviation and Pearson correlation coefficient – r.

After pressing the needle on the skin and registering the deviation of the arrow on the scale, recorded the data, which were then statistically processed. For the calculation, we took p=0.05 (95%), Student's t-test = 2.

The study was performed in accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Local Ethics Committee of the university. The informed consent was obtained from the patients.

Results of the study and discussion

To understand how informative our results will be, first, we calculated the average pain sensations for all patients (227 people) who participated in the study. Therefore, the mean data when the patient did not feel pain was 18.8 g (SD=7.6). The mean data when the patient experienced mild pain was 46.1±15.7 g and the mean data when the patient experienced severe pain was recorded at 82.8±27.6 g. In other words, when pressed with a needle with a force of up to 18.8 g, the subjects did not feel pain, and with increasing force began to feel the appropriate level of pain of medium and severe levels.

At the same time, we calculated the data and saw how the feeling of pain changes according to the growth of BMI. We entered the obtained data in Table 1.

Thus, as seen from the table, people from the Group I (with normal body weight) did not feel pain when pressing the needle with a force of 13.3±2.6 g. While people of the Group II did not feel pain when pressing the needle with a force of 20.5±4.0 g, and people of the Group III – 29.8±8.2 g. The sensation of moderate pain was observed at the level of 36.6±3.4 g in the Group I and at the level of 51.7±4.0 and 59.0±8.9 in the Groups II and III, respectively. Feelings of severe pain were as follows. In the Group I, they were recorded at 64.1±5.7 g. In the Group II – at the level of 89.8±6.7 g and in the Group III – at the level of 101.3±13.0 g.

If the correlation (Pearson correlation coefficient – r) between BMI in general and the deviation of the algometer arrow was positive but was for the group without pain – 0.28, then for the group with mild pain it increased to 0.32, and for the groups with severe pain – up to 0.38, which indicates a positive correlation dynamic.

Thus, with increasing body weight and with an increasing degree of obesity, the threshold of pain sensitivity

Fig. 2. A method of determining pain sensitivity in the forearm

increases, i.e. with an increasing degree of obesity, people are more resistant to mechanical pain irritation. In other words, with increasing obesity, people experience less pain than people with normal body weight.

To date, there is no consensus among scientists on the level of pain sensitivity in people with different body weights. Some scientists say that obesity increases pain [1]. Others also suggest that obesity limits organ function and increases pain in the neck, back, hip, knee, and ankle joints than in the general population [8]. But here we can agree with the authors because obese patients significantly increase the load on the joints due to weight gain.

Interestingly, other authors who evaluated the intensity of postoperative pain in obesity and non-obese lung cancer reported that the incidence of pain in obese lung cancer patients was greater than in obese patients who underwent the same operation on the chest. In obese patients, severe pain persisted longer. Pain treatment is an important factor in postoperative care for lung cancer patients, especially with obesity [6].

However, other authors point out that pain sensitivity does not differ in obese and healthy people [4]. Some authors seek to systematize research on the relationship between pain and obesity [3] and identify the root causes of such relationships. For example, E. Amy Janke et al.

Table 1

Average pain sensations by groups

Groups	Number of patients, n	No pain, Mean ± CI (g)	Mild (light) pain, Mean ± CI (g)	Severe pain, Mean ± CI (g)
I	101	13.3±2.6	36.6±3.4	64.1±5.7
II	91	20.5±4.0	51.7±4.0	89.8±6.7
III	36	29.8±8.2	59.0±8.9	101.3±13.0

[5] point to a link between pain and overweight/obesity for a variety of reasons: mechanical, structural, metabolic, behavioral changes, and most likely a combination of these factors. Other authors, after conducting their research, conclude the following: «Individuals with severe obesity displayed hypoalgesia to noxious electrical stimuli together with difficulty in grading experimental noxious thermal and electrical stimuli in between pain threshold and tolerance. We argue that the latter may have a significant effect on pain treatment and consequently needs to be taken into account when treating the patients with obesity for acute or chronic pain» [10]. Other authors directly confirm that obese participants are less sensitive to pain than non-obese individuals, but only in areas with excess subcutaneous fat [9].

Conclusions

As we can see, even today there is no consensus on the impact of obesity on the threshold of pain sensitivity and the degree of pain. In our opinion, one of the reasons is that the form of assessment of pain in humans is diverse and not systematic. But evaluating the data from the literature, conducting our research, and taking into account our clinical experience, we came to the following conclusions:

1. With increasing body weight and with an increasing degree of obesity increases the threshold of pain sensitivity, i.e. with an increasing degree of obesity people are more resistant to mechanical pain irritation.

2. There is a pattern of greater resistance of obese people to mild, moderate, and severe mechanical irritation on average 1.5–2 times more than people with normal body weight.

3. Reduced pain sensation in obese people can be one of the reasons for both the masked «hypoanalgesic» development of purulent and inflammatory processes of soft tissues and acute inflammatory, oncological, and destructive processes of internal organs.

4. Increasing the threshold of pain sensitivity in people with increasing obesity makes it possible to reconsider approaches to postoperative analgesia because, in terms of kg of body weight, obese patients need fewer painkillers than patients with normal body weight.

The authors declare no conflict of interest.

References/Література

1. Basem JI, White RS, Chen SA, Mauer E, Steinkamp ML et al. (2021). The effect of obesity on pain severity and pain interference. Pain management. 11(5): 571-581. https://doi.org/10.2217/pmt-2020-0089.
2. CDC. Defining Adult Overweight & Obesity. URL: https://www.cdc.gov/obesity/adult/defining.html
3. Chin SH, Huang WL, Akter S, Binks M. (2020). Obesity and pain: a systematic review. International journal of obesity. 44(5): 969-979. https://doi.org/10.1038/s41366-019-0505-y.
4. Emerson NM, Nahman-Averbuch H, Peugh JL, Coghill RC. (2021). Pain sensitivity does not differ between obese and healthy weight individuals. Pain reports. 6(3): e942. https://doi.org/10.1097/PR9.0000000000000942.
5. Janke EA, Collins A, Kozak AT. (2007). Overview of the relationship between pain and obesity: What do we know? Where do we go next? Journal of rehabilitation research and development. 44(2): 245-262. https://doi.org/10.1682/jrrd.2006.06.0060.
6. Majchrzak M, Brzecka A, Daroszewski C, Błasiak P, Rzechonek A, Tarasov VV et al. (2019). Increased Pain Sensitivity in Obese Patients After Lung Cancer Surgery. Frontiers in pharmacology. 10: 626. https://doi.org/10.3389/fphar.2019.00626.
7. Khimich S. (1997). Level of sensitivity of pain in patients with obesity. Acta chirurgica Hungarica. 36(1-4): 166-167.
8. Peltonen M, Lindroos AK, Torgerson JS. (2003). Musculoskeletal pain in the obese: a comparison with a general population and long-term changes after conventional and surgical obesity treatment. Pain. 104(3): 549-557. https://doi.org/10.1016/S0304-3959(03)00091-5.
9. Price RC, Asenjo JF, Christou NV, Backman SB, Schweinhardt P. (2013). The role of excess subcutaneous fat in pain and sensory sensitivity in obesity. European journal of pain (London, England). 17(9): 1316-1326. https://doi.org/10.1002/j.1532-2149.2013.00315.x.
10. Torensma B, Oudejans L, van Velzen M, Swank D, Niesters M, Dahan A. (2017). Pain sensitivity and pain scoring in patients with morbid obesity. Surgery for obesity and related diseases: official journal of the American Society for Bariatric Surgery. 13(5): 788-795. https://doi.org/10.1016/j.soard.2017.01.015.

Відомості про авторів:

Хіміч Сергій Дмитрович *– д.мед.н., проф., зав. каф. загальної хірургії ВНМУ ім. М.І. Пирогова. Адреса: м. Вінниця, вул. Пирогова, 56. https://orcid.org/0000-0002-8643-2140.*

Малишевський Ігор Олександрович *– к.мед.н., доц., Ген. директор ОКНП «Буковинський клінічний онкологічний центр». Адреса: м. Чернівці, вул, Червоноармійська, 242. https://orcid.org/0009-0007-5831-8256.*

Чорнопищук Роман Миколайович *– д.мед.н., доц. каф. загальної хірургії ВНМУ ім. М.І. Пирогова, зав. Центру термічної травми та пластичної хірургії КНП «Вінницька обласна клінічна лікарня ім. М.І. Пирогова ВОР». Адреса: м. Вінниця, вул. Пирогова, 46. https://orcid.org/0000-0001-5422-7495.*

Кателян Олена Вікторівна *– к.мед.н., доц. каф. загальної хірургії ВНМУ ім. М.І. Пирогова. Адреса: м. Вінниця, вул. Пирогова, 56. https://orcid.org/0000-0003-2343-9983.*

Стаття надійшла до редакції 29.10.2024 р., прийнята до друку 18.03.2025 р.