Pressure ulcers in surgery patients: incidence and associated factors*

ÚLCERA POR PRESSÃO EM PACIENTES SUBMETIDOS À CIRURGIA: INCIDÊNCIA E FATORES ASSOCIADOS

ÚLCERA POR PRESIÓN EN PACIENTES SOMETIDOS A CIRUGÍA: INCIDENCIA Y FACTORES ASOCIADOS

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ABSTRACT

Pressure ulcers are an important perioperatory care quality indicator This is a longitudinal case series study, performed with the following objectives: to estimate the incidence of pressure ulcers in patients submitted to medium and large surgeries; rate them according to the stage and location; verify the association with the variables: gender, age, body mass index (BMI), co-morbidities, surgical position, duration of surgery, anesthesia type and use of positioning devices, with presence or absence of pressure ulcers. Data collection took place in 2007 in São Paulo, with 199 patients, 20.6% of which presented pressure ulcers, and most (98.6%) in stages I and II, and the main location was the trunk (35.1%). The variables: position, surgery time, general anesthesia, and device use had a statistically significant association. In conclusion, there is a high incidence of pressure ulcers among surgical patients, requiring actions aimed at reducing this type of injury.

DESCRIPTORS

Pressure ulcer
General surgery
Patient positioning
Periperative nursing

RESUMO

As úlceras por pressão constituem um dos principais indicadores da qualidade do cuidado na assistência perioperatória. Este é um estudo longitudinal, do tipo série de casos, com o objetivo de estimar a incidência de úlceras por pressão em pacientes submetidos a cirurgias de médio e grande portes; classificá-las segundo estágio e localização, verificar a associação das variáveis sexo, idade, índice de massa corpórea, comorbidades, posição cirúrgica, tempo cirúrgico, anestesia e uso de dispositivos de posicionamento com a presença ou ausência de úlceras por pressão. Os dados foram coletados em 2007, em São Paulo, com 199 pacientes, dos quais 20,6% apresentaram úlceras por pressão, 98,6% nos estágios I e II, com localização predominante no tronco frontal (35,1%). As variáveis: posição, tempo cirúrgico, anestesia geral e uso de dispositivos apresentaram associação estatística significativa. Concluiu-se que a incidência de úlceras por pressão em pacientes cirúrgicos é elevada, demandando ações que visem à redução desse tipo de lesão.

DESCRITORES

Úlcera por pressão
Cirurgia geral
Posicionamento do paciente
Enfermagem perioperatória

RESUMEN

Las úlceras por presión constituyen uno de los principales de calidad del cuidado en atención perioperatoria. Estudio longitudinal, tipo serie de casos, objetivando estimar la incidencia de úlceras por presión en pacientes sometidos a cirugías de media y gran magnitud; clasificarlas según estado y localización, verificar asociación de variables sexo, edad, índice de masa corporal, comorbilidades, posición quirúrgica, tiempo quirúrgico, anestesia y uso de dispositivos de posicionamiento con presencia o ausencia de úlceras por presión. Los datos fueron recolectados en 2007, con 199 pacientes en San Pablo, de los cuales 20,6% presentaban úlceras por presión, 98,6% en los estados I y II, localizadas predominantemente en tronco frontal (35,1%). Las variables posición, tiempo quirúrgico, anestesia general y uso de dispositivos demuestran asociación estadística significativa. Se concluye en que la incidencia de úlceras por presión en pacientes quirúrgicos es elevada, demandando acciones que apunten a la reducción de este tipo de lesiones.

DESCRIPTORES

Úlcera por presión
Cirugía general
Posicionamiento del paciente
Enfermería perioperatoria

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INTRODUCTION

A pressure ulcer (PU) is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction[1-2].

PUs are classified in stages from I to IV, based on tissue loss rather than on injury severity. Studies show that, the greater the tissue damage, the higher the stages of development of the ulcer and the cost of treatment[1,3-4]. The most common classification in use is that of the *National Pressure Ulcer Advisory Panel* (NPUAP)[1], which has been translated to Portuguese[2] and is used in the present study.

Regarding surgical patients, one of the most common complications is the development of stage I and II PUs during surgery. The ulcers can be observed immediately after the surgery and can advance rapidly to stages III and IV[1,5-6], though they can also be observed a few days after surgery. This occurs because the skin and deeper tissues suffer tissue hypoxia and hypoxemia due to compression during surgery[6-7]. Based on the duration of the surgeries, we can classify them as Small or Size I if lasting up to two hours; Medium or Size II for those lasting from two to four hours; and Large or Size III is the duration is of more than four hours[8].

...every surgical patient should be considered as being at a high risk to develop PU. Therefore, nurses working in the surgery department must provide thorough nursing care, implementing the necessary measures to avoid or minimize this type of injury...

Several risk factors are associated with the etiopathogenesis of PU, which appear during surgery and can be grouped into intrinsic and extrinsic factors. The main intrinsic factors are: age; body weight; nutritional status; chronic diseases such as diabetes mellitus, vasculopathies, neuropathies, hypertension, and anemia. Extrinsic factors include: surgery type and duration, anesthesia, surgical positions and positioning[5-7,9].

The higher the intensity of these factors and duration of the surgery, the greater the risk to develop PU[5-6]. Studies show that about 95% of PUs occur on the sacral and coccygeal regions, ischial tuberosity, and greater trochanters [5-6,10].

In this setting, every surgical patient should be considered as being at a high risk to develop PU. Therefore, nurses working in the surgery department must provide thorough nursing care, implementing the necessary measures to avoid or minimize this type of injury, considering the factors susceptible to change[6,9].

Literature on skin lesions points that the intraoperative period is the most prone to the development of PU, with incidence ranging between 4.4% and 66%[3,5,11]. Taking these data into consideration, the present article was performed to detect the factors associated with the occurrence of PU during surgery.

METHOD

This longitudinal case series study[12] was developed at a large private general hospital located in São Paulo, where all types of surgeries are performed, at an average of 1500 per month, and with not description of a specific routine for patient positioning on the surgical table, or a systematization of the pre and post-operative evaluation regarding PUs. After being approved by the Research Ethics Committees of the institutions (Protocols 0088/07 and 126/2006, respectively), the data were collected between February and May 2007, complying with the ethical principles for research performed with human beings. All patients provided written consent prior to their participation.

During the referred period, a total of 3781 surgeries were performed, 1758 of which were medium and large surgeries. A draw was performed to select 199 patients complying with the following inclusion criteria: being conscious, age above 18 years, and be scheduled for surgeries of size II and/or III, regardless of the specialty. Patients who, in the immediate pre-operative evaluation, presented any type of skin lesion, impaired physical mobility, and reduced tissue perfusion in any region of the body, as well as polytrauma patients, were excluded from the study. Based on these criteria, only one patient was excluded on the account of presenting skin lesion on a lower limb. All patients agreed to participate in the study.

Patients were included in the sample according to the daily schedule of surgeries, which also provided information about the size of the surgery (II or III), and complying with the inclusion criteria.

Data were collected using a specific instrument created based on literature and the researcher's clinical experience. Furthermore, the instrument was submitted to the appreciation of two surgical nurse specialists and one wound treatment nurse specialist to evaluate its pertinence to the propositions of the study. The evaluators made few suggestions, and all were incorporated to the instrument. A pre-test was then performed with the final version of the instrument on ten patients, who were not included in the study sample, with the purpose of verifying is the test was appropriate for the planned data collection strategy.

A single researcher performed the data collection to follow the patients. The researcher was trained in PU evaluation, which took place at three different times: immediate pre-operative, transoperative, and on the first day post-operative.

In the pre-operative period, patients were approached at the reception of the surgery department and then taken to the surgery room where they were interviewed and submitted to an exam to evaluate skin integrity, tissue perfusion, and physical mobility, and information was collected from their medical records. The data collected in this period were used to decide if the patient would be included in the sample or not, and were compared to other data in the further phases.

In the transoperative period, the researcher collected data regarding the surgery that was performed, its duration, type of anesthesia, the surgical position, the protection measures that were used, and any complications.

On the first day post-operative, the researcher repeated the interview and physical exam.

The data were analyzed by grouping the PUs according to body regions. Therefore, lesions located on the forehead, eyelids, ears, lips, and chin were included in the *head* region. The *frontal trunk* included lesions on the chest, breast, abdomen, iliac crest, and suprapubic region. The *dorsal trunk* included lesions on the scapula and sacrum. *Lower limbs* referred to lesions on the axilla, arm, forearm, while *lower limbs* referred to lesions on the knee and heel.

The qualitative variables were presented as numbers and percentages, and the quantitative variables were summarized as means, standard deviations, and minimum and maximum values. The *surgery time* variable was expressed by the median and interquartile variation (first quartile [Q1] and third quartile [Q3]), minimum and maximum values, as such variation did not show normal distribution.

To estimate the presence of PU, the confidence interval was also calculated, at 95% (CI at 95%).

The comparison between PU presence and absence was evaluated using the Chi-Square or Fisher's Exact Test. The association strength magnitude was evaluated by calculating the *odds ratio* (OR), and its respective confidence interval (CI at 95%). The *surgery time* variable was compared using the Mann-Whitney test.

For the multivariate analysis, an unconditional logistic regression model was used to identify the morbidity between variable and independent variables. To compose this model, variables were included if they had a p-value below 20%.

In every statistical analysis, a 5% significance level (α=0.05) was used, i.e., p-value below 5% ($p<0.05$), along with SPSS software for Windows 12.0.

RESULTS

The data on Table 1 show a homogeneous distribution of male and female patients, of ages ranging between 18 and 94 years (mean of 52.6), and 65.8% younger than 60 years. The patients' weight varied considerably (41 kg to 184 kg), with a mean 76.5kg and standard deviation of 18.1kg. In view of this variability, we chose to work with the classification of patients according to their BMI and it was found that most patients were within standards of normality (78 – 39.2%) and overweight (77 – 38.7%).

Table 1 – Participants' gender, age and BMI variables - São Paulo - 2007

Variables	N	%	Mean ± standard deviation	Minimum – Maximum
Gender				
Male	101	50,8		
Female	98	49,2		
Age			52,6 ± 18,1	18 – 94
18 to 39 years	52	26,1		
40 to 59 years	79	39,7		
≥ 60 years	68	34,2		
BMI classification			27,0 ± 6,2	16,9 – 63,7
Underweight	6	3,0		
Normal	78	39,2		
Overweight	77	38,7		
Obesity I	20	10,1		
Obesity II	8	4,0		
Morbid Obesity	10	5,0		
Total	**199**	**100**		

Note: (N=199)

As to the comorbidities, 92 (46.2%) patients referred having some disease at the time of the preoperative interview, of which systemic hypertension was the most frequent, considered alone as well as associated with other diseases (66 patients, 71.8%).

Table 2 – Surgery variables according to size, type of anesthesia, position, and use of positioning devices - São Paulo - 2007

Surgery characteristics	N	%
Size		
II	108	54,3
III	91	45,7
Type of anesthesia		
General	166	83,4
Local (block)	33	16,6
Position		
Dorsal	121	60,8
Ventral	34	17,1
Lateral	27	13,6
Fowler	11	5,5
Lithotomy	6	3,0
Use of positioning devices		
Arm holder	181	91,0
Pad	93	46,7
Leg holder	7	3,5
Total	**199**	**100**

Note: (N=199)

As to the specialties, orthopedic surgeries were the most common (25%), followed by neurosurgeries (22%) and gastric surgeries (22%), corresponding to 69% of all surgeries performed.

The data on Table 2 shows that most patients (54.3%) were submitted to size II surgeries, used general anesthesia (83.4%), and adopted a dorsal position in 60.8% of the cases. As to the use of positioning devices, the arm holder was the most frequent (91%), followed by pads (46.7%).

It was observed that 41 of the 199 evaluated patients developed PU, which corresponds to a 20.6% incidence (CI at 95% - [15.2%; 26.9%]). Most cases (61%) presented one lesion, though 16 patients (39%) presented more than one, adding up to 74 PU.

As to the stage of the lesions, Table 3 shows that most (73 – 98.6%) were stage I and II. Most stage I PUs were located on the heel (9 -12.1%), chest (9 – 12.1%), sacrum (5 – 6.7%), and iliac crest (5 – 6.7). Stage II PUs occurred on the sacral region (10 – 13.5%) and eyelids (6 – 8.1%).

Table 3 – Pressure ulcers according to severity, location, and association with the patient's surgical position - São Paulo - 2007

Location	Position									
	Dorsal		Ventral		Lateral		Lithotomy		Total	
	N	%	N	%	N	%	N	%	N	%
Stage I										
Heel	09	12.1							09	12.1
Chest			07	9.4	02	2.7			09	12.1
Sacrum	05	6.7							05	6.7
Iliac crest			03	4.0	02	2.7			05	6.7
Knee			04	5.4					04	5.4
Breasts			04	5.4					04	5.4
Abdomen			03	4.0					03	4.0
Frontal			02	2.7					02	2.7
Chin			02	2.7					02	2.7
Axilla			01	1.4					01	1.4
Upper limbs	01	1.4							01	1.4
Ear					01	1.4			01	1.4
Suprapubic			01	1.4					01	1.4
Total Stage I	**15**	**20.2**	**27**	**36.4**	**05**	**6.7**			**47**	**63.5**
Stage II										
Sacrum	09	12.1					01	1.4	10	13.5
Eyelids			06	8.1					06	8.1
Heels	04	5.4							04	5.4
Chest			02	2.7	02	2.7			04	5.4
Scapula					01	1.4			01	1.4
Lips			01	1.4					01	1.4
Total Stage II	**13**	**17.5**	**09**	**12.1**	**03**	**4.0**	**01**	**1.4**	**26**	**35.1**
Stage III										
Chin			01	1.4					01	1.4
Total Stage III			**01**	**1.4**					**01**	**1.4**
Total overall	**28**	**37.8**	**37**	**50.0**	**08**	**10.8**	**01**	**1.4**	**74**	**100**

Note: (N=74)

Also according to Table 3, there was an association between the ventral position and a greater number of PUs, adding up to 37 (50%) ulcers, with most occurring on the chest (9 – 12.1%), eyelids (6 – 8.1%), breasts and knees (4 cases [5.4%] each). Among the lesions that occurred in this position, 27 (36.4%) were stage I; nine (12.2%), were stage II, and one (1.4%) was stage III.

According to the PU location and grouping by body region, Table 4 shows that the trunk was the most affected body region, and that 35.1% of PUs occurred on the frontal trunk region.

Table 4 – Pressure ulcers according to the location - São Paulo - 2007

Pressure ulcer location	N	%
Head	13	17.5
Frontal trunk	26	35.1
Dorsal trunk	16	21.6
Upper limbs	02	2.8
Lower limbs	17	23.0
Total	**74**	**100**

Note: (N=74)

The results from the statistical analysis between the variables *gender, age,* and *BMI* and the development of PU were not statistically significant (p>0.05), as we observed there was homogeneity between patients with and without PU.

It was found that, regardless of the comorbidity reported by the patient or recorded on the medical file, most did not present PU, therefore we did not identify any statistically significant association between the two variables (Exact Fisher's Test – p=0.314).

Among the 44 patients submitted to neurosurgeries, 36% presented PU, thus showing a statistically significant association with this type of surgery (p=0.042). Compared to the other specialties, neurosurgeries had the greatest incidence of patients with PU (p=0.003). Therefore, the chance of a patient submitted to neurosurgeries present PU was about three-fold that observed among the other specialties (IC 95% [1,41 ; 6,28] - p=0,004).

Table 5 lists the data regarding the surgery (time, size, type of anesthesia, position), with or without PU, that showed a statistically significant association with the duration/size of surgery, type of anesthesia, surgical position and the use of pads.

Table 5 – Surgery data, according to the presence or absence of pressure ulcer - São Paulo - 2007

Surgery data	Pressure Ulcer					
	Present (n = 41)		Absent (n = 158)		OR [CI 95%]	p-value
Surgery duration (h)	6:10 (2:58 ; 4:30)		3:35 (4:45 ; 7:37)			<0.001
Size	**N**	**%**	**N**	**%**		<0.001
III	36	39.6	55	60.4	13.484 [5.005 ; 36.325]	
II	5	4.6	103	95.4		
Anesthesia						0.024
General	39	23.5	127	76.5	4.760 [1.090 ; 20.790]	
Local (block)	2	6.1	31	93.9		
Position						<0.001
Ventral	13	38.2	21	61.8	3.323 [1.424 ; 7.756]	
Lateral	8	29.6	19	70.4	2.260 [0.865 ; 5.905]	
Lithotomy	1	16.7	05	83.3	1.074 [0.119 ; 9.711]	
Dorsal	19	15.7	102	84.3	1.000	
Fowler			11	100.0		
Devices						
Leg holder						
Yes	2	28.6	05	71.4	1.569 [0.293 ; 8.395]	0.598
No	39	20.3	153	79.7		
Arm holder						
Yes	39	21.5	142	78.5	2.197 [0.484 ; 9.9967]	0.376
No	2	11.1	16	88.9		
Pads						
Yes	27	29.0	66	71.0	2.688 [1.310 ; 5.516]	0.007
No	14	13.2	92	86.2		

Note: (N=199)

Surgery duration ranged between 2h and 11h20', with a median of 3h50', and an interquartile variation of 3h to 5h10'.

This variable is what differentiated the groups statistically, indicating that the median duration of surgery of patients with PU was longer than that of patients without PU (p<0.001). Although there was a significant difference, it was not possible to estimate the *odds ratio* for that variable, as the logarithm for the *odds ratio* of surgery duration was not linear. Therefore, we chose to evaluate this chance using the *surgery size* variable, as it was created based on the surgery duration. In conclusion, the chance of patients submitted to a size III surgery to present PU is 13.5 times greater than that observed among patients submitted to a size II surgery (p<0.001).

As to the *type of anesthesia*, we observed that the patients' chance to present PU among those submitted to general anesthesia is 4.8 times greater than the chance presented by patients submitted to local anesthesia (p=0.024).

For surgery *position*, it was found that the chance to develop PU among patients in the ventral position is 3.3 greater than that observed among patients in the dorsal position, and the ventral position was the only one that showed statistical significance. It is also worth mentioning that it was not possible to estimate the *odds ratio* for the *fowler* position, because none of the patients in this position presented PU.

There was a statistically significant association between the *use of pads* and the presence of PU (p=0.007),

and the chance of a patient presenting PU among those who used pads was 2.7 times greater than that observed among patients submitted to surgery without using this device.

DISCUSSION

The present study results regarding the PU incidence in patients submitted to medium and large surgeries are in agreement with literature, which states that PU incidence in patients submitted to surgeries of more than two hours can range between 4.7% and 66%, with most PU classified as stage I and II [3,5,10].

The difference between incidence rates can be attributed to the different methodological criteria used to evaluate this event. For instance, a study with 84 patients submitted to elective surgeries lasting more than two hours showed that 56.8% of patients presented PU, and all were classified as stage I[10]. Another study, performed with 208 patients of different specialties, who were submitted to surgeries of more than four hours, found a smaller PU incidence (31.3%), but 21.2% were stage I, and 10.1% were stage II[3].

On the other hand, a study with 125 patients submitted to elective surgeries of different specialties, with duration ranging from less than two to more than eight hours, found a PU incidence of 12%[5]. Another study, with 337 patients submitted to cardiac surgery lasting more than two hours, only 16 (4.7%) progressed with a total of 22 ulcers, 13 of which were stage I, 5 stage II, and four were not classified[13].

It should be noted that the PU incidence found in this study might have been underestimated because the physical exam to identify the lesion was performed only preoperatively, and literature points out that tissue damage can be observed from the immediate postoperative period until up to five days after surgery. Several authors state that in some cases the PU are not observed immediately after the pressure had ceased and, sometimes, are not diagnosed as PU as they are not observed and/or reported or, yet, are confused with reactive hyperemia[6-10].

On the other hand, other authors point out that about 70% of PU can be observed only until the first day postoperative[2,5], which implies that the data from this study are representative of the studied phenomenon.

In the present study, the surgery duration, which defines its size, was statistically significant ($p<0.001$) for PU occurrence, which suggests that the chance of patients submitted to a size III surgery present PU is 13.5 greater than that observed for patients submitted to a size II surgery.

This occurs because the surgery durations is a significant indicator of the risk for tissue damage, as long periods of immobilization and exposure to pressure can cause tissue ischemia, which lead to anoxia and necrosis, thus resulting in the PU[9].

In addition, evidence was found for the fact that the chance of a patient who used general anesthesia to present PU is 4.8 times greater than those who used local anesthesia ($p=0.024$). It is certain that this correlation is also associated with surgery duration and size, as longer surgeries usually make use of general anesthesia. This finding also agrees with literature in that it points at general anesthesia as a factor predisposing the occurrence of PU due to immobilization and absence of skin sensitivity, in addition to changes in blood pressure, tissue perfusion, the patient's response to pain, and the oxygen and carbon dioxide exchange[6-7,9].

Another important aspect observed was the relationship between the location, PU stage, and the patient's position in the surgery.

An association was observed between the ventral position and a greater number of lesions, accounting for 50% of the PUs, most of stage I and II, and only one of stage III. In this position, the most affected body regions were the chest (12.1%), eyelids (8.1%), breasts and knees (5.4%). These findings are also confirmed by literature, which presents the same body regions listed in this study among those that suffer the most pressure in this position[5-7,10,14].

In this position, the patient's remains with the abdomen facing down, arms extended to the front and supported by arm holders, thus the potential points of pressure are the ears, eyelids, cheeks, the acromion, chest, breasts (women), penis and scrotum, patella, and toes[8,14].

Another aspect is that the *position, duration/size*, and *anesthesia* variables are determined by the *type of surgery* variable, which, in turn, is associated with the occurrence of PU. That association is confirmed by the present study findings, which show that patients submitted to a neurological surgery have a three-fold chance to develop PU compared to that of patients submitted to surgeries of other specialties ($p=0.004$).

It should be noted that neurosurgeries in the ventral position include spinal surgeries, and this could have determined the higher PU incidence observed in the present study for this specialty. This hypothesis is supported by a study that found a higher PU incidence in patients submitted to spinal surgeries[15]. Furthermore, literature recommends that for surgeries performed in the ventral position, the patients' head should be placed in a lateral position and supported on a pad, keeping the neck aligned with the spine, and avoid any folding of the ears on the Wilson frame or any appropriate positioning devices, using gel, for instance, to redistribute the pressure made on the chest, breasts, male genitalia, patella and toes, elevating the chest and allowing free movement of the diaphragm and lung expansion. The arms should be supported on arm holders and kept at about the same level of (parallel to) the surgical table. When using the Wilson frame, a pad should be placed under the patient's knees and ankles to avoid pressure on the patella and toes, for plantar flexion of the feet[8,14]. It should also be stressed that, in the present study, the positioning devices used consisted of sheets rolled into the form of pads, which are hard and leave no contact between the patient and the surface of the mattress, in a way that it does not reduce the pressure to the tissue. This factor may have contributed to the high incidence of ulcers in this position, and, consequently, in this specialty.

It is likely that this type of pad in the ventral position contributed to the surprising finding that *pad use* was statistically associated with the presence of PU (p=0.007).

Studies report on several types of positioning devices, made from state-of-the-art material, and more effective than the devices that are conventionally used to avoid PU caused by surgical positioning[16-17]. The researcher, themselves, recommend the development of further studies using experimental designs, and addressing the cost-effectiveness of the tested devices. It should, however, be stressed that incorporating new knowledge into practice requires a permanent education policy at the institution, in order to disseminated the knowledge and encourage the professionals involved about the need to use that knowledge[18].

No statistical association was found between the variables *gender*, *age*, *BMI* and *presence of comorbidities* and the occurrence of PU, though there is literature reference to all of them as being possible risk factors[7-8,10]. This result can be explained by the main inclusion criterion – surgery size – which served as a parameter to calculate the sample and not the aforementioned variables.

CONCLUSION

The present study results show there is a high incidence of PU (20.6%) in surgical patients; 98.6% of PU were classified as stage I and II; and 56.7% were located on the trunk region, 35.1% in the frontal trunk. It was also found that there was a statistically significant association between Pus and surgeries in the ventral position, size III surgeries, and the use of general anesthesia and pads.

Therefore, all surgical patients should be systematically evaluated throughout the perioperative period as to the risk factors to developing PU, which would serve as the basis for making decisions about which preventive measures should be implemented.

This is a relevant field of research that should be further developed nursing in order to increase the knowledge specific to the field, but aiming at a practice based on the best available evidence, and thus contribute to improving the qualification of perioperative nursing care.

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