EFFECTS OF POSITIVE SUGGESTIONS ON THE NEED FOR RED BLOOD CELL TRANSFUSION IN ORTHOPEDIC SURGERY

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Abstract: This study examined whether positive suggestions applied without a hypnotic induction in the perioperative period reduces the need for red blood cell transfusions in patients who underwent total hip or knee arthroplasties with spinal anesthesia. No hypnotic assessment was performed. Ninety-five patients were randomly assigned to the suggestion group ($n = 45$) and to the control group ($n = 50$). Patients in the suggestion group received verbal suggestions before and audiotaped suggestions during the surgery for reducing blood loss, anxiety, postoperative pain, and fast recovery. Our study showed that using positive suggestions in the perioperative period significantly decreases the necessity for transfusion.

The use of hypnosis in the medical field is becoming more and more accepted worldwide. During a formal hypnotic procedure with an induction, the patient is likely to shift to a modified mental state that increases his or her acceptance of suggestions. Giving suggestions in this context can be used for different goals under medical circumstances (e.g., anesthesia, to decrease pain, vomiting, and/or the need for medications). Several studies were published in which patients

Manuscript submitted May 10, 2014; final revision accepted November 9, 2015.
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were hypnotized before or during a surgical intervention and the effectiveness of suggestions received in hypnosis were analyzed (Ashton et al., 1997; Enqvist, von Konow, & Bystedt, 1995; Ghoneim, Block, Sarasin, Davis, & Marchman, 2000; Hart, 1980; Kiss & Butler, 2011; Lang et al., 2000; Mauer, Burnett, Ouellette, Ironson, & Dandes, 1999; Montgomery et al., 2007; O’Shea, Dodd, Panayiotou, & Palmer, 2011; Rapkin, Straubing, & Holroyd, 1991). According to the meta-analysis of Montgomery, David, Winkel, Silverstein, and Bovbjerg (2002), 89% of surgical patients benefited from adjunctive hypnosis interventions relative to patients in control conditions.

As is well known, suggestions also may be effective out of hypnosis (Meyer & Lynn, 2011), and they can be used to improve patients’ recovery (Bejenke, 1996; Cheek, 1969; Ewin, 2011; Kekecs, Jakubovics, Varga, & Gombos, 2014; Varga, 2011, 2013). The application of positive suggestions following the protocol of Varga, Diószeghy, and Fritúz (2007) and Szilágyi, Diószeghy, Benczur, and Varga (2007) decreased the length of time patients were on a ventilator in an intensive care unit. This finding was successfully replicated recently (Szilágyi, Diószeghy, Fritúz, Gál, & Varga, 2014), along with a reduced drug intake (Schlanger, Fritúz, & Varga, 2013). The authors emphasized the importance of keeping patients informed, and they focused the patient’s attention on the signs of gradual recovery while applying suggestions to relax the patient. Several studies confirmed that taped positive suggestions played during surgery can decrease postoperative vomiting, length of hospitalization, and time of the return of gastrointestinal motility (Cowan, Buffington, Cowan, & Hathaway, 2001; Disbrow, Bennett, & Owings, 1993; Eberhart, Döring, Holzrichter, Roscher, & Seeling, 1998; Kekecs & Varga, 2013; Nilsson, Rawal, Uneståhl, Zetterberg, & Unosson, 2001).

**Special Characteristics of Knee and Hip Surgeries**

Among orthopedic surgeries, hip and knee arthroplasties are the most common great joint surgeries. The extent of blood loss during these operations can be so severe that red blood cell transfusion becomes necessary. It is well known that, although red blood cell transfusion is increasingly safe, it is still not without risk. It may have immunological and nonimmunological and immediate and late onset adverse effects (Miskovits, 2008). Studies suggested that perioperative red blood cell transfusion significantly increases the rate of complications (Abbas, Murtaza, Umer, Rashid, & Qadir, 2012), and it influences the length of stay in the hospital (Jonas, Smith, Blair, Dacombe, & Weale, 2012).
Based on the above, it is obvious that decreasing the red blood cell transfusion rate during and in the days after these surgeries has prominent relevance to the patient’s health and postoperative recovery. Furthermore, decreasing the red blood cell transfusion rate is relevant for health care institutions as well: Preparation and administration of transfusions burdens the medical staff, the preparation of blood products has high costs, and sometimes the institution even faces the problem of scarce blood stock. There are several methods to reduce blood loss—and, therefore, potentially the need for red blood cell transfusions—during a surgical intervention. One possibility is that the anesthesiologist maintains a controlled hypotension, but even a transitory elevation of blood pressure can lead to increased bleeding. Blood loss during surgery can be decreased by medication as well, such as tranexamic acid (Charoencholvanich & Siriwatanasakul, 2011; de Jonge, 2012; Yang, Chen, & Wu, 2012). However, the use of this product at orthopedic surgeries to reduce blood loss was not authorized in Hungary at the time of the study.

Until now, only a few trials have dealt with the effectiveness of suggestions during the perioperative period aiming to decrease blood loss, and all of these suggestions were given under hypnosis. Hart (1980) examined the amount of blood loss and the need for blood transfusion in open heart surgeries; Rapkin et al. (1991) examined head and neck cancer surgeries; Enqvist et al. (1995) examined maxillofacial surgeries; and Ross (1982) examined dental surgeries. In their studies, they used suggestions of relaxation, quick recovery, and visual imagery to facilitate hemostasis and successful postsurgical recovery. Based on their results, the amount of blood loss was reduced by the given suggestions, and they also showed that the decrease in blood loss was higher in those patients with higher hypnotizability scores (Rapkin et al., 1991; Ross, 1982). Other trials where the aim of hypnotic suggestions was to influence the diameter of certain vessels were also successful. With the help of hypnosis, Klapow, Patterson, and Edwards (1996) increased the circulation of the lower extremity of patients suffering from Burger’s disease. Zachariae, Oster, and Bjerring (1994) decreased blood perfusion of ultraviolet B radiation-induced erythema. Reinhard, Hüskens-Janssen, Hatzmann, and Schiermaier (2009) decreased the resistance of the umbilical artery in pregnant women. In all of these studies, suggestions were given either personally (verbally) or via audiotape. There was no significant difference between these two methods of hypnosis administration (Montgomery et al., 2002).

The research hypothesis of our study was that among patients who undergo hip or knee prosthesis surgery with spinal anesthesia, patients who receive positive suggestions without a hypnotic induction before
the intervention (personally) and during the surgery (using audiotape) will lose less blood than patients who do not receive any positive suggestions. Thus, our primary objective was to compare the necessity of red blood cell transfusion of patients receiving and not receiving positive suggestions.

**Method**

To test our hypothesis, we performed a randomized, prospective clinical trial between April 2011 and January 2013. Eligible patients were to undergo a total hip or knee arthroplasty surgery with spinal anesthesia at the Department of Orthopedic Surgery at the University of Debrecen. The study was authorized by the Institutional Ethical Committee. Before enrollment, all patients gave their written informed consent.

Upon enrollment, patients were randomized into two groups. Patients in the suggestion group received not only the usual information from their surgeon and anesthesiologist but they also participated in a personal verbal discussion about the expected events with a third doctor. This third doctor was the same person (C.S.) for all patients; although she was an orthopedic surgeon (i.e., not a psychologist), she did not operate on any of the enrolled patients. During this semi-standardized discussion, not only extra information was given but also direct suggestions to decrease the bleeding. Furthermore, this discussion presented the opportunity to personalize the suggestions to the questions and concerns of each patient. Then, during the surgery, patients listened to a 90-minute audiotape of suggestions connected by relaxing music. This included suggestions aimed at relaxing the patient, reframing the meaning of intraoperative noises, decreasing postoperative pain, and—most important—giving direct suggestions to decrease blood loss in the perioperative period. For example, “Your body withdraws the redundant blood from the surgical field. Only as much blood flows there as is required to supply the tissues with sufficient nutrition and oxygen . . . . There is no need for bleeding.” The complete text of these suggestions is available from the first author; part of it with explanations is published in Szeverenyi, Csernátóny, Balogh, and Varga (2013). Patients in the control group received care as usual (i.e., information given by their surgeon and anesthesiologist). No hypnotic assessment was performed at the beginning of the study. We did not find it necessary, partly because we were not to perform hypnosis, partly because we wanted to avoid mentioning the term hypnosis to the patients, since we did not want to influence the effect of the intervention. We wanted to develop a method that is effective and usable routinely with any patient (not only with highly hypnotizable
ones) and by health professionals who are trained in suggestion intervention but not necessary in hypnotherapy. Our approach was based on using suggestive techniques while providing information to the patients (see this method in several areas of medicine in Varga, 2011).

Patients were randomized in a 1:1 ratio to these two treatment groups, using a stratified block design (with block size of 4) via tossing a coin. The randomization was stratified by two factors that are thought to influence blood loss (Enqvist et al., 1995). These were the type of the surgery (cemented vs. noncemented hip prosthesis vs. knee prosthesis) and the experience of the surgeon (experienced vs. inexperienced). The latter factor affects the surgical technique and the length of the operation, which might have an indirect effect on bleeding. Surgeons who have been doing arthroplasties for at least 5 years after their specialty exam were considered experienced.

It is known that the number of required red blood cell transfusions during or after arthroplasties is further influenced by patient age, preoperative hemoglobin level, and patient weight (Ahmed, Chan, Jenkins, Brenkel, & Walmsley, 2012; Kotzé, Carter, & Scally, 2012; Noticewala, Nyce, Wang, Geller, & Macaulay, 2012). Considering these and other factors that influence other objectives of the study, we aimed to define a patient population that is homogenous from a medical point of view. Therefore, the following patients were excluded from the study: patients with hemorrhagic disorders, congenital or acquired immunodeficiency, diabetes mellitus, moderate and severe heart failure (New York Heart Association Functional Class III-IV), alcoholism, liver failure, body mass index (BMI) of 40 or higher, Jehovah’s Witnesses (who refuse blood transfusions), and patients with defective hearing (who cannot hear the suggestions). Furthermore, those patients who received general anesthesia and those with surgical complication leading to increased bleeding (such as bone fracture or vessel injury) would also be excluded from the analysis after randomization. To rule out hemorrhagic disorders, laboratory tests of hemostasis were routinely checked for each patient before surgery, including International Normalized Ratio (INR), activated partial thromboplastin time (APTT), and Thrombin Time (TT). For all patients included in the analysis, the operation was performed with spinal anesthesia, but, because the patients received narcotics and sedatives as well (midazolam, nalbuphine, propofol, fentanyl, droperidol), most of them were sleeping lightly. (There was no difference in the amount of tranquilizers between the two treatment groups.) According to their pharmacological description, none of the used medication has any effect on bleeding (European Medicines Agency, 2016).

The decision whether or not to transfuse to a specific patient is regulated by our institutional protocol. During the surgery, the anesthesiologist decides on the need of transfusion if the estimated blood loss
reaches 500 ml. After the operation, the orthopedic surgeon on duty decides based on the hemoglobin level: It should not decrease below 100 g/l on the day of the surgery and below 90 g/l from Postoperative Day 2 on.

Throughout the study, we recorded the number of units of red blood cell transfusions during and after the intervention (one unit is equal to 200 ml red blood). To prove our hypothesis, the ideal would have been to directly measure the blood loss as well. At the time the study was designed, the primary objective also included measurement of blood loss during and after the intervention. However, for technical reasons, it was impossible to gain exact measures: We had to face already at the beginning of the study that the blood flowing onto the isolation textile is immeasurable and thus data collection was also imprecise. Therefore, we did not collect and analyze these data and used the amount of blood transfusions as a surrogate endpoint to assess blood loss. Due to standard institutional guidelines, we believe this is an adequate endpoint to address our research hypothesis.

In clinical practice, 2 units of red blood cells are always given at a time. The only way to receive an odd number of units is when, even though the medics indicated two units, it was technically not possible to receive both. Thus, for our primary endpoint it makes complete sense that patients for whom 1 or 3 units were recorded are categorized as those who received 2 or 4 units, respectively. Furthermore, because in these types of operations, within the population specified for this study, it is very rare to receive more than 4 units of red blood, all patients receiving at least 4 units were grouped together. Thus, we would categorize the patients into three groups based on how many units of red blood they received (0, 2, and 4 units).

Statistical Analysis

Ordinal logistic regression was applied to model the number of red blood cell units received. For the other variables, the difference between treatment groups was tested using an unpaired t test (age, BMI, baseline INR, APTT, TT, duration of surgery) or Pearson chi-square test (gender). Hemoglobin and hematocrit values were also represented per time point: before the surgery, on the day of the surgery—after the potential intraoperative transfusions—and on the second and sixth postoperative days (PO2, PO6).

Results

From the 120 eligible patients in the examined period, 116 signed the informed consent form and were randomized: 57 patients to the suggestion group and 59 to the control group. Based on the previously
defined exclusion criteria, 21 of the 116 randomized patients were later excluded from the analysis. Of the remaining 95 patients, 45 belonged to the suggestion group and 50 to the control group.

Table 1 shows that there was no significant difference between treatment groups in gender, age, and BMI. Furthermore, there was also no significant difference between treatment groups in baseline hemostasis laboratory parameters (INR, APTT, TT). There was also no significant difference in the mean duration of the surgical intervention. Furthermore, as was expected due to the stratified randomization, there was no difference between treatment groups in the performed surgical types and in the surgeons’ experience (see Tables 2 and 3).

The vast majority of the patients (more than 90%) received 0, 2, or 4 units of red blood. Very few patients received an odd number of units (2 patients received 1 unit—one each in the suggestion and control groups; 3 patients received 3 units—one in the suggestion group, 2 in the control group). Furthermore, as expected, very few patients received more than 4 units of blood (1 patient received 5 units, 2 received 6 units, and 1 received 8 units—all in the control group). These subjects, as described in the method section, were grouped with the subjects who received 4 units.

Figure 1 displays the frequencies for the number of units of red blood cells. It can be noted that most of the patients are in the two-unit category in both groups (51% and 54%). However, the proportion of patients

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Demography, Baseline Characteristics, and Duration of Surgical Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suggestion</td>
</tr>
<tr>
<td></td>
<td>n = 45</td>
</tr>
<tr>
<td>Mean age (SD), year</td>
<td>67.1 (7.50)</td>
</tr>
<tr>
<td>Mean BMI (SD), kg/m2</td>
<td>29.1 (4.33)</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>13 (29%)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>32 (71%)</td>
</tr>
<tr>
<td>Mean Baseline INR* (SD)</td>
<td>0.94 (0.051)</td>
</tr>
<tr>
<td>Mean Baseline APTT* (SD), second</td>
<td>28.6 (2.82)</td>
</tr>
<tr>
<td>Mean Baseline TT* (SD), second</td>
<td>17.0 (1.66)</td>
</tr>
<tr>
<td>Mean duration of surgical intervention (SD), minute</td>
<td>110.0 (28.9)</td>
</tr>
</tbody>
</table>

Note. SD = Standard Deviation; BMI = body mass index, INR = International Normalized Ratio; APTT = activated partial thromboplastin time; TT = Thrombin Time.

* Suggestion: n = 41, Control: n = 40.
Table 2  
*Distribution of Patients by Type of Surgery Performed*

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>Suggestion n = 45</th>
<th>Control n = 50</th>
<th>Total N = 95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncemented hip</td>
<td>17 (37.8%)</td>
<td>18 (36.0%)</td>
<td>35 (36.8%)</td>
</tr>
<tr>
<td>Cemented hip</td>
<td>10 (22.2%)</td>
<td>12 (24.0%)</td>
<td>22 (23.2%)</td>
</tr>
<tr>
<td>Hybrid hip*</td>
<td>0</td>
<td>1 (2.0%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>Knee</td>
<td>18 (40%)</td>
<td>19 (38.0%)</td>
<td>37 (38.9%)</td>
</tr>
</tbody>
</table>

*Hybrid hip: one component of the prosthesis is cemented, the other is noncemented.

Table 3  
*Distribution of Patients by the Experience of the Surgeon*

<table>
<thead>
<tr>
<th>Experience of the Surgeon</th>
<th>Suggestion n = 45</th>
<th>Control n = 50</th>
<th>Total N = 95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experienced</td>
<td>33 (34.7%)</td>
<td>38 (40.0%)</td>
<td>71 (74.7%)</td>
</tr>
<tr>
<td>Inexperienced</td>
<td>12 (50.0%)</td>
<td>12 (50.0%)</td>
<td>24 (25.3%)</td>
</tr>
</tbody>
</table>

who did not need red blood cell transfusion is higher for the suggestion group (42.2%) than for the control group (26%). Consistently, the proportion of patients in the four-unit category is lower for the suggestion group (6.7%) than for the control group (20%). The results of the ordinal logistic regression indicate that less transfusion was needed in the suggestion group: odds ratio (Suggestion Group vs. Control Group) of 2.369 (p value = .0036). Interesting to note that when looking at the intra- and the postoperative transfusions separately, this significant difference in the total number seems to be driven by the difference in both the intra- and the postoperative transfusions (see Table 4).

There was no difference between treatment groups in hemoglobin and in hematocrit measured before the operation, on the day of the operation (after the transfusion), and on the second and sixth postoperative days (see Figure 2).

**Discussion**

In our study, we found that the necessity for blood transfusions significantly and clinically relevantly decreased in the suggestion group compared to the control group. In other words, the same hemoglobin and hematocrit level could be achieved with fewer transfusions in the
Figure 1. Distribution of Patients by the Amount of Red Blood Cell Transfusion Received.

Table 4
Distribution of Patients by the Amount of Blood Transfused During and After Operation

<table>
<thead>
<tr>
<th>Number of units of red blood cell received</th>
<th>Suggestion $n = 45$</th>
<th>Control $n = 50$</th>
<th>Total $N = 95$</th>
</tr>
</thead>
<tbody>
<tr>
<td>During Operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>36 (80.0%)</td>
<td>33 (66.0%)</td>
<td>69 (72.6%)</td>
</tr>
<tr>
<td>2</td>
<td>9 (20.0%)</td>
<td>16 (32.0%)</td>
<td>25 (26.3%)</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1 (2.0%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>After Operation</td>
<td>26 (57.8%)</td>
<td>23 (46.0%)</td>
<td>49 (51.6%)</td>
</tr>
<tr>
<td>2</td>
<td>18 (40.0%)</td>
<td>22 (44.0%)</td>
<td>40 (42.1%)</td>
</tr>
<tr>
<td>4</td>
<td>1 (2.2%)</td>
<td>5 (10.0%)</td>
<td>6 (6.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>19 (42.2%)</td>
<td>13 (26.0%)</td>
<td>32 (33.7%)</td>
</tr>
<tr>
<td>2</td>
<td>23 (51.1%)</td>
<td>27 (54.0%)</td>
<td>50 (52.6%)</td>
</tr>
<tr>
<td>4</td>
<td>3 (6.7%)</td>
<td>10 (20.0%)</td>
<td>13 (13.7%)</td>
</tr>
</tbody>
</table>

suggestion group. This result is consistent with that of other studies that dealt with the effectiveness of suggestions during the perioperative period aiming to decrease blood loss (Enqvist et al., 1995; Hart, 1980; Rapkin et al., 1991; Ross, 1982). The novelty of our results is that the suggestions in our study were not given under hypnosis. In our study, we did not induce hypnosis because our secondary aim was to demonstrate that the applied communication method can be learned and used by all doctors without being a hypnotherapist. One possibility for further research is to test if formal hypnosis would increase the effect and/or to test if the efficacy of the suggestion
method is related to hypnotizability. A recent meta-analysis shows that, although hypnosis effect sizes are usually higher than that of suggestive interventions (without hypnosis), this difference is not significant (Kekecs, Nagy, & Varga, 2014).

Also note that we cannot be sure whether the significant effect was due to the suggestions given during the interview or via the audiotaped material—although they might facilitate each other. In addition, the verbal suggestions were semi-standardized discussions that may act as a confounding variable due to the personalization. Another question around the audiotaped material is whether the effect was really due to the suggestions or to the more relaxed state. A further research possibility is to check the difference if one group receives only suggestions for relaxation.

Another limitation of the study was the impossibility to blind the study, since we wanted to have a “care as usual” group, where the patients do not have additional discussions and do not listen to any special audiotaped material but who hear the noises of the surgery. Nevertheless, we do not believe that the fact that the caregivers potentially could be aware of the randomized treatment group significantly influenced the amount of blood transfused, first, because the indication for red blood cell transfusions is strictly regulated in our department and, second, because both the intraoperative and postoperative transfusions decreased—whereas these are decided by different caregivers (anesthesiologist vs. orthopedic surgeon on duty).

**Conclusion**

Hip and knee arthroplasties are long and stressful interventions for the patients. The extent of intraoperative blood loss sometimes
necessitates blood transfusions during and after the operation. Giving blood to the patient has many risks and is expensive to the health care institutes. In our study, we showed that positive suggestions applied both before and during the surgery decrease the required units of red blood transfused. The results are in line with other evidence indicating that the recovery of the patients in stressful situations can be enhanced by correctly applied suggestions (Kekecs & Varga, 2011; Varga, 2005). Finally, their application is cheap and does not require extra time from the physician. Thus, we propose this method as part of the daily work in the clinical practice.

FUNDING

The mp3 players were bought by the University of Debrecen. No other financial support was received.

REFERENCES


Effekte positiver Suggestionen im Falle der Notwendigkeit von Bluttransfusionen bei orthopädischen Eingriffen

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Stephanie Reigel, MD

Les effets de suggestions positives sur la nécessité d’une transfusion sanguine pendant une chirurgie orthopédique

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Résumé: Cette étude a permis de vérifier si des suggestions positives faites sans induction hypnotique pendant la période périopératoire peuvent réduire le besoin d’une transfusion sanguine chez des patients subissant une arthroplastie totale de la hanche ou du genou avec rachianesthésie. Aucune évaluation hypnotique n’avait été effectuée au préalable. Quarante-vingt-cinque patients ont été aléatoirement affectés au groupe recevant des suggestions hypnotiques (\(n=45\)) ou au groupe témoin (\(n=50\)). Les sujets du groupe affectés aux suggestions hypnotiques ont reçu celles-ci de façon verbale avant la chirurgie et de façon enregistrée pendant la chirurgie, ces suggestions visant à réduire la perte de sang, l’anxiété et la douleur postopératoire, et à favoriser un rétablissement rapide. Notre étude a permis de montrer que l’utilisation de suggestions positives pendant la période périopératoire diminue significativement la nécessité d’une transfusion.

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C. Tr. (STIBC)

Efectos de sugerencias positivas sobre la necesidad de transfusión de glóbulos rojos en cirugías ortopédicas.

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Resumen: Este estudio examinó si sugerencias positivas transmitidas sin inducción hipnótica en el periodo preoperatorio reducen la necesidad de
transfusión de glóbulos rojos en pacientes sometidos a una arthroplastia de cadera o rodilla con anestesia epidural. No se realizó una evaluación hipnótica. Noventa y cinco pacientes fueron aleatoriamente asignados al grupo de sugerencias ($n = 45$) o al control ($n = 50$). Los pacientes en el grupo experimental recibieron sugerencias verbales antes de y sugerencias audiograbadas durante la cirugía para la reducción de pérdida de sangre, ansiedad, dolor postoperatorio y una recuperación rápida. Nuestro estudio mostró que el uso de sugerencias positivas durante el periodo preoperatorio significativamente reduce la necesidad de transfusión.

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