Do educational and empowerment sessions reduce stress levels before knee arthroplasty?

Montse Nuevo 1, Aida Rodriguez-Nuevo 1, Alicia Hervas 2, Adriana Arza-Valdés 3,5, Jorge Mario Garzón-Rey 3,5, Jordi Aguiló 3,4,5, Teresa Faura 1

1 Clinic Institute of Medical and Surgical Specialties (ICEMEQ), Hospital Clinic of Barcelona, Barcelona, Spain
2 Clinic Institute of Digestive and Metabolic Diseases (ICMDM), Hospital Clinic of Barcelona, Barcelona, Spain
3 Biomonitoring Group. Biomedical Research Networking Center (CIBER-bbn)
4 Integrated Systems Department. Microelectronics Institute of Barcelona

Abstract

Objective: The aim of this study is to demonstrate the effectiveness of the empowerment session in reducing stress associated with knee surgery, establishing a statistically significant correlation between both of them.

Methods: In this study 32 patients undergoing knee arthroplasty were subjected to an empowerment session. Their level of stress was measured by ECG measurement to assess heart rate variability, and by psychometric test scoring before and after the session.

Results: Heart rate variability (HRV) values positively correlate with scores of psychometric tests. HRV were increased by and STAI-state and VASS scores were reduced, thus stress levels were reduced after the empowerment session. The group who perceived to be stressed due to the surgical procedure was the one who reduced the most the stress levels.

Conclusions: The results of the experimental study objectively demonstrate that empowerment session significantly reduces the stress related to a surgical prescription.

Practical Implications: Educational and empowerment sessions can improve patient welfare and, thus surgical outcomes.

Keywords

Patient empowerment, surgical stress, knee arthroplasty, rapid recovery.

Introduction

The objective of this study is to explore the link between the empowerment of patients and the decrease in stress levels associated to a surgical prescription. The work presented was conducted in the context of a "Fast Track or Rapid Recovery" surgery for patients who undergo knee arthroplasty, which was implemented in 2011 in Hospital Clinic of Barcelona. The protocol "Fast Track or Rapid Recovery" aims to optimise surgical outcomes, increase patient satisfaction and reduce costs. The program is based on a coordinated effort of a multidisciplinary team to combine process optimisation, patient education before surgery, new anaesthetic, analgesic and pharmacological techniques and review of the fundamental principles of the pre and postoperative in order to define an active physical regimen and an early mobilisation [1]. The present study is focused on the improvement of all aspects of the experience of the patients: preoperative evaluation, hospital discharge and return to home with the objective of reducing the stress associated to the procedure.

We can define stress as a situation of biological activation triggered by the interaction of individuals with external agents (i.e. illness, injury, surgery, etc.), which force them to adapt in order to survive, altering the body homeostatic balance. Thus, there are stressors that promote physiological disturbances; the body activates both the nervous and endocrine systems. Along with physiological changes, the behaviour is also altered and leads to very counterproductive situations for fast and effective recovery from surgery. A large
number of patients present psychological disorders in the preoperative stage, what we denominate negative emotional stress [2]. Surgery is a potent and complex stressor triggered by hospitalisation, the disease itself and the events and consequences that it entails [3]. It involves not only common fears such as disorientation, loss of privacy, neglect of the environment and the usual roles [4], but also personal fears like not waking from anaesthesia, feeling pain during the operation, disclose personal information due to anaesthesia or surgery results. All these situations result in an unresolved stress that leads to high levels of anxiety that impact on the individual unfavourably. Thus, the success of the surgery is affected by the mental state of patients before surgery and during the recovery process [5,6].

According to the World Health Organization (WHO), therapeutic education is an integrated care and patient-centered continuous process. It aims to help patients to understand the disease and treatment, cooperate with professional educators, live as healthily as possible and maintain or improve quality of life. Empowerment uses therapeutic education to increased confidence, knowledge and gives tools to the patients to help them deal with different stressful situation [7]. In this sense, education brings a range of tailor-made expertise not only in physiology, such as symptoms and signs that may be expected, but also in a functional level, like the activities of daily life that will be altered [8–11]. These education sessions have proved effective in promoting empowerment in patients who will undergo surgery [12]. A study in patients scheduled to undergo hip replacement surgery, showed no significant differences in the method of educating patients. The variables of anxiety, depression, quality of life and stress improved equally regardless whether the materials to educate patients were videos, brochures or anatomical models [13]. On the other hand, there is evidence that many patients preferred written material or brochures [13–15]. Currently, the most used method in patient education is the verbal education by health care professional or a combination of both verbal and written materials [16–18]. Although there is controversy in the educational method that need to be implemented, most authors agree in emphasising the need to conduct session with both verbal and written material [19–21].

After analysing the literature and knowing the impact of stress on a patient who will undergo knee arthroplasty, we aim with this study to demonstrate objectively that the empowerment session contributes decisively to reduce stress levels in these patients.

Patients and Methods

2.1. Data collection

The present study is experimental, prospective and observational, and was conducted in the Hospital Clinic of Barcelona. The study includes 32 patients undergoing knee arthroplasty. Exclusion criteria were: under 18, no informed consent, women in the third trimester of pregnancy and patients with heart diseases. There is no control group, due to the fact that for the Knee Unit at the Hospital Clinic is mandatory for all patients to be subjected to this session. The ethics committee of the Hospital Clinic of Barcelona approved the study protocol.

2.2. Physiological and Psychometric Measurement

Stress levels were measured using both physiological and psychometric methods. The R-peak series of ECG signal (RR) detection algorithm is based on discrete wavelet transform. The HRV signal was obtained using the method described in [22], which is based on the IPFM model. An ectopic beat removal method was employed to eliminate the ectopic beat and noise peaks in the RR and HRV signal as described in [23]. In this study, the ECG was recorded using the system ABP-10 module (Medicom MTD Ltd, Russia). Regarding the psychometric methods each patient underwent three different psychometric tests following the advice of the Psychiatric Unit of the Clinical Hospital of Zaragoza: the State-Trait Anxiety Inventory (STAI) which evaluates the anxiety, the Visual Analogue Stress Scale (VASS) that is used to directly determine the level of stress perceived by the patient and the Perceived Stress Scale (PSS), which evaluates the perceived stress in the last month.

The STAI consists in two differentiated parts. First, the STAI-trait (anxiety-trait; A/T), which evaluates the personality features of each individual to respond to situations perceived as threatening [24]. Second, the STAI-state (anxiety-state; A / S), which refers to a transitory and variable emotional state. Therefore, the former is more stable and the latter more prone to vary both in time and intensity. The PSS is a self-report instrument that assesses the level of perceived stress during the last month. It consists on questions designed to assess the degree to which situations in life are appraised as stressful using a five-point scale as response format [25]. Finally, the patients were asked to appoint a level of stress using a visual analogue stress scale (VASS), which allows a simple, fast scoring, avoiding inaccurate terms of description in the assessment of the perceived stress levels.

2.3. Sequential events

The empowerment session is conducted between 2 and 4 weeks before surgery. It is a group session of five patients who will undergo knee arthroplasty and who are accompanied by a relative or caregiver. A physiotherapist and a nurse lead this session, in which it is explained to patient-family-caregiver everything that will happen from that moment on. The information includes an explanation of the type of anesthesia, the surgery, the discharge criteria, recommendations on what to bring to hospitalization and also indications of what to practice at home until surgery: physiotherapy exercises, transfers and how to roam on crutches; all of them are practiced in situ by the patients in the session. During the session the patient-familycaregiver may ask any questions they have as it is proposed as an interactive meeting, hence patient-family-caregiver can resolve all their doubts. To further ensure the knowledge transfer the group receives a visit of a
patient who is undergoing or underwent the same surgery and once held the empowerment session. At the end they will receive a brochure with the information needed to perform physical therapy exercises at home and to bring everything the day of surgery. The assessment of every patient had the following sequence: first, the ECG recording to determine the HRV. Second, the patients answered 4 psychometric tests: STAI-state, STAI-trait, PSS and VASSS; followed by a standardized clinical interview to obtain the sociodemographic data. After this assessment, patients were informed in the empowerment session and then their stress levels were determined again by ECG measurement and psychometric tests.

2.4. Data analysis

The scores of the psychometric tests and HRV indices were compared using Pearson’s correlation to determine the dependence between the physiological and psychological measures. Data before and after the empowerment session were compared with T-test of Student for paired samples and using One-way ANOVA to compare three groups. Postoperative care and physiotherapy.

Results

3.1. Statistical study of the characteristics of the subjects

The sociodemographic characteristics of the subjects studied were considered in order to determine whether the empowerment session affected differently to the patients.

The average age of the subjects is 72 years and 78% of them were female. Regarding the level of education, nearly half of the subjects are included in the low level and the other half in medium level. 84% are sedentary, keeping this ratio in both men and women. 94% of the study subjects are retired, the rest are unemployed or active. Finally, 86% of men are married, while women are mostly divided between married and widowed. The vast majority of the subjects (80%-95%) are adults of around 72 years old, sedentary, retired and are married or widowed (Table 1).

As for the clinical characteristics of the patients, the mean BMI is 29%, showing that the subjects are overweight and limit the obesity (≥30%). Most (70%-80%) of the subjects have a Level II ASA (American Society of Anesthesiologists) and have not had surgery in the last 6 months. About 70% of the group of subjects says they are stressed by the surgery (Table 2).

| Table 1. Description of the sociodemographic characteristics of the subjects studied. |
|-----------------|----------|----------|----------|
|                | Total    | Men      | Women    |
| Age (Mean (SD))| 72.25 (8.00) | 73.57 (7.07) | 71.88 (8.34) |
| Gender         | 32 (100%) | 7 (22%)  | 25 (78%) |
| Level of education | Low     | 17 (53%) | 3 (43%)  | 14 (56%) |
|                | Medium   | 14 (44%) | 4 (57%)  | 10 (40%) |
|                | High     | 1 (3%)   | 0 (0%)   | 1 (4%)   |
| Marital status | Single   | 2 (6%)   | 0 (0%)   | 2 (8%)   |
|                | Married  | 17 (53%) | 6 (86%)  | 11 (44%) |
|                | Widowed  | 13 (41%) | 1 (14%)  | 12 (48%) |
| Occupation     | Retired  | 30 (94%) | 7 (100%) | 23 (82%) |
|                | Unemployed | 1 (3%)  | 0 (0%)   | 1 (4%)   |
|                | Active   | 1 (3%)   | 0 (0%)   | 1 (4%)   |
| Sedentary      | No       | 5 (16%)  | 0 (0%)   | 5 (20%)  |
|                | Yes      | 27 (84%) | 7 (100%) | 20 (80%) |

| Table 2. Description of the clinical characteristics of the subjects studied. |
|-----------------|----------|----------|----------|
|                | Total    | Men      | Women    |
| IMC (Mean (SD))| 29.53 (3.75) | 29.43 (3.34) | 29.56 (3.92) |
| Recent surgery | No       | 25 (78%) | 6 (86%)  | 19 (76%) |
|                | Yes      | 7 (22%)  | 1 (14%)  | 6 (24%)  |
| ASA            | I        | 7 (22%)  | 2 (29%)  | 5 (20%)  |
|                | II       | 22 (69%) | 4 (57%)  | 18 (72%) |
|                | III      | 3 (9%)   | 1 (14%)  | 2 (8%)   |
| Self-perceived stress | No       | 5 (16%)  | 2 (29%)  | 3 (12%)  |
|                | Yes, family situation | 4 (13%)  | 1 (14%)  | 3 (12%)  |
|                | Yes, surgery related | 23 (72%) | 4 (57%)  | 19 (76%) |
3.2. Psychometric test score are correlated with HRV values

In order to determine whether the psychometric tests are measuring the same type of stress that induces a decrease in the HRV, correlation assays were perform. The Pearson correlation index for the sum of psychometric test (STAI-State and VASS) and HRV (Figure 1) shows a $\rho$ equal to -0.2729 with a P-value equal to 0.0291 indicating that there is a relationship between psychometric tests and the HRV.

![Figure 1. Plot of Psychometric Tests values and HRV scores. Pearson correlation analysis results in a Pearson coefficient of $\rho$ = -0.2729 with a p-value = 0.0291](image)

3.3. The empowerment session reduces stress levels

Comparative analysis of the values obtained before and after the empowerment sessions revealed a statistically significant increase in the HRV after the session of empowerment, which suggests a reduction of the stress levels (Figure 2A). There is also a substantial decrease of the values of the STAI-state test and VASS, which reinforces that there is a correlation between these two objective measures of stress (Figure 2B). The STAI-trait scorings are not changing remarkably, since the test reports a personality feature, which is unlikely to change with the educational session. The PSS test values do not present any differences and serve as the negative control because the test reports stress perceived in the last month, which remains unchanged after the empowerment session (Figure 2B).

3.4. Gender and self-perceived stress influence the level of improvement

To further determine the beneficial impact of the empowerment session, the data was analyzed to detect any influence of the sociodemographic characteristics of the subjects on their stress levels before and after the session and also their improvement potential. Although the analysis comprised all the parameters measured in the study, the VASS was the measurement showing more differences. The sociodemographic characteristics used for the division of the groups were: gender, education level, marital status and self-perceived stress. The rest of the features were discarded because the groups obtained using these parameters did not achieve the statistical power required.

The analysis of the VASS data shows that women present higher stress levels than men before the empowerment session, but also after, thus both men and women improve their stress levels in the same manner (Figure 3A). Also assessing the VASS data the subjects were divided into three groups: those who claimed not to have stress, those who reported stress from family situation and those who reported stress associated to the surgery. The analysis shows that those who perceive stress associated to the surgery reduced their stress level significantly more (Figure 3B). This result supports the positive effect of empowerment session on patients that will be surgically treated. Regarding education level and marital state, we did not find any statistically significant differential influence of these characteristics on the stress levels or the improvement.

**Discussion**

The group of subjects is homogeneous for the sociodemographic characteristics as 80% of the subjects are around 72 years old, sedentary, retired, and either married or widowed. However there are three times more women than men. Aiming to find a physiological measurable parameter, the study proposed the HRV to be representative of the stress levels of the patients. The results show a direct correlation between HRV and the values of the psychometric tests. This indicates that both variables are reliable objective measurements of the stress levels and thus will be used for the rest of the study. Stress measurements before and after the empowerment session revealed that there is a statistically significant increase of the HRV, which suggests that the empowerment session is beneficial for...
the subjects. Furthermore, three of the psychometric tests used in this study show positive results in terms of stress reduction. STAI-state and EVA were decreased with robust significance; STAI-trait was significantly reduced as well, unlike PSS. The fact that the STAI-trait is not as reduced as STAI-state can be explained due to the fact that the STAI-trait measures personality features rather than temporary variable stress levels. PSS psychometric test showed no significant change, as expected because the tests measures the patient perceived stress during the last month. The analysis of different tests revealed that STAI-state and VASS test are the most sensitive to the type of stress associated with surgery, which is the object of study of this work. The study of the influence of sociodemographic characteristics on the stress levels in the different variables studied before, after, and also in the difference after the session of empowerment, showed that gender and self-perceived stress are the characteristics that impact on how the subjects improve their stress levels. Women show higher stress levels before and after the session than men. However, both men and women benefit from the empowerment session in the same rate. The self-perceived stress revealed that those who perceive to be stressed because of the surgical procedure are the one more beneficiated by the empowerment session and improve significantly more than those who are stress due to the family situation or those who claim not to be stressed in the first place.

Conclusion

In summary, there is a statistically significant correlation between HRV and the psychometric test STAI-state and VASS, but not with the PSS and STAI-Trait test due to the specific characteristics of the test, which entail HRV as a reliable measurement of stress levels. The type of empowerment session conducted in the Knee Unit of the Hospital Clinic of Barcelona decreases stress levels of patients soon to be undergoing knee arthroplasty, denoted by a significant increase in HRV and significant decrease in the score of STAI-state and VASS psychometric tests. Although women are more stress in both time points, men and women reduce their stress levels more than 50% after the empowerment session. Interestingly, the subjects perceived to be stressed due to surgical procedure are the ones who benefit most from the empowerment session.
Practice Implications

The results of the present study emphasize the importance of patient education. The empowerment session conducted in the Knee Unit of the Hospital Clinic of Barcelona has proved to reduce stress levels in patients soon to be undergoing knee arthroplasty. This reduction in stress levels will improve not only the welfare of the patient but also the surgical outcomes, as the patient will undergo surgery in a more balanced state. Therefore, it is crucial to further investigate the beneficial effects of the empowerment session conducted before all different types of programmed surgery and start implementing this practice in the preoperative procedures.

References


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Conflicts of interest statement

The authors certify that they have no affiliations with or involvement in any organisation or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

Correspondence

Montse Nuevo Gayoso. Physiotherapist.
Clinic Institute of Medical and Surgical Specialties (ICEMEQ), Hospital Clinic. C/ Villarroel 170. Barcelona 08036
E-mail: monuga@gmail.com

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