

Original Research Paper

General Surgery

HEART RATE VARIABILITY AFTER GENERAL SURGICAL PROCEDURES

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KEYWORDS :				

Introduction:-

Heart rate variability (HRV) is becoming a powerful non-invasive tool which can be used in disease of cardiovascular system, neurologic, Multiple organ dysfunction syndrome (MODS), sepsis, brain and head injuries etc;

Electrocardiogram (ECG) recording is useful in assessment of various cardiovascular diseases. HRV is derived from R-R interval of ECG. The clinical utility of HRV in various diseases are being studied and its analysis gives information about the interaction between sympathetic and parasympathetic activity of autonomic nervous function. The loss of decreased variability in beat to beat intervals has been found in various pathophysiological disorders.(4-9).

The analysis of HRV depends on the time domain and Frequency domain. Reduction in time domain parameters e g. Root mean square of standard deviation (RMSSD) shows the sympathetic dominance and frequency domain analysis provides the separation of parasympathetic(High frequency HF) and (Low frequency LF) signals.

After surgical procedures, the patient in postoperative ward has to be managed for surgical pain and/or sepsis due to postoperative infections. The pain and sepsis do cause the loss of variability in HRV low frequency component low to high frequency ratio during septic shock. These reports show potential value of HRV in management of patients for pain and maintenance of hospital environment against post operative infections. HRV, thus becomes quantitative assessment of patients management in postoperative wards.

Further, unfamiliar environment, depending on strangers, separation from family and friends, perceived physical risk. Possible anaesthetic, postoperative complications, threat to death are possible to cause pre operative anxiety and stress in the patients. Compared to spinal anaesthesia (SA), General anaesthesia (GA) produces more post operative stress in patients. In this context, the aim of this study is to compare HRV, which is assigned to be a marker for stress, in patients who underwent General or spinal anaesthesia at the time of discharge from the hospital. HRV ultimately becomes the index about the welfare of the patients and efficiency of pre and post operative management of the patients.

METHODS

A total of 140 patients, who have undergone general surgery for various ailments, were included for HRV study. The inclusion criteria were that the patient (a) aged 20-65yrs (b) had not consumed

any medication for the past 18hrs (c) underwent general surgery and assigned to get discharged next day.

The exclusion critera were : Those who are on cardiovascular drugs and thyroid drugs(other than for thyroid surgery)

The sample size was determined by statistical software and resulting sample size was 55 in both groups. The institutional ethical committee clearance was obtained for the study. Written informed consents were obtained from the patients who were included into the study.

The HRV measurement procedures:-

The HRV was measured with single channel ECG and analyzed with Norwegian software to produce time or frequency domain parameters. Root mean square of standard deviation (RMSSD) was used as it was shown to decrease when a person was under stress (time domain analysis).

We also used power spectral density to find the distribution of HRV at different frequencies (frequency domain analysis)

The total power is a short term estimate of total power of spectral density in 0 to 0.4 H2 representing overall activity of autonomic nervous system (ANS). Very low frequency (VLF 0.033 and 0.4 H2) reflect the overall activity of sympathetic function. Low frequency (LF between 0.04 to 0.15 H2) reflect mixed sympathetic and para sympathetic activities.

High frequency 0.15 to 0.4 H2 reflect the parasympathetic activity which includes sinus arrhythmia. High values of low to high (LF/HF) ratio indicate a dominance of sympathetic activity, while low values indicate a dominance of parasympathetic activity. Inducement of pain or stress due to general surgery can cause heart rate to increase and total power and high frequencies to decrease and low frequencies and the LF/HF ratio to increase.

Male or female patients along with one of his or her accompanying person were allowed in the laboratory such that patient should be comfortable with the laboratory environment. The patients were connected to a computerised ECG analyser(The analyser is fed with single channel ECG (lead II) The four limbs were electrically connected with conventional ECG electrodes (colour coding).Single channel limb lead(II lead) is displayed in the computer screen and used for HRV analysis.

Anaesthesia procedures for GA and SA

For General anaesthesia: Medicines used for general anaesthesia are:-

For premedication - Inj.Glycopyrolate; Inj.Midozolam, Inj.Fentanyl - I.V

For induction-Thiopentonel sodium / Propofol/Ketamine - I.V

Muscle Relaxant:-Scoline; Long acting muscle relaxant -Atracurium, Vecuronium

Gases used are Oxygen; Nitrous Oxide, Isoflurane / sevoflurane

For reversal:- Neostigmine; Glycopyrolate.

Postoperative pain management was with Inj. Diclofenac sodium, Inj.Tramadol and night sedation with Inj. Fortwin with Inj phenergan I.M, H.S.

For spinal anaesthesia :- Before giving spinal anaesthesia, Patient was given Inj.Ranitidine; Inj.Emeset Inj. Bupivacaine 0.5%.(Heavy) was used for Spinal anaesthesia.

After giving spinal anaesthesia patient will be on i.v. sedation

Postoperative pain management was with Inj. Diclofenac sodium, Inj. Tramadol and night sedation with Inj. Fortwin with Inj phenergan I.M, H.S.

Results:

During the period between January to July 2015, 140 patients who underwent various general surgeries in post operative wards and due for discharge the next day were included for the present study. The surgeries done in the patients are listed as in Table 1. They then were divided into groups based on the route of anaesthesia, namely, general(GA) or spinal(SA) anaesthesia. The patients were sent to electro-physiology department for HRV measurements. In GA group 76 and in SA group 64 completed the HRV readings and were used for statistical analysis.

The Age distribution of patients in both groups was not significantly different (Table I) (p > 0.05). The distribution of male and female were not statistically significant. Thus both groups are comparable. Table II shows the results of HRV variables in GA and SA patients at the time of discharge from the hospital. The results also indicate the RMSSD in both the groups are comparable. RMSSD in GA group is not significantly different from that in SA group. The other parameters of frequency domain such as total power, %LF, %HF or LF/HF ratio are not significantly different statistically (Table II).

TABLE-1 Demographic and surgery related Data

Variable	General anaesthesia	Spinal Anaesthesia
Mean(SD)	(n=76)Mean(SD)	(n=64)
Age (Years)	50.5(14.1)	49.5(16.9)
Sex	n(%)	n(%)
Male	39(51)	31(48)
Female	37(49)	33(52)

Types of SURGERY done in patients and their stay in post operative ward

Gen anaesthesia	Stay in ward(Days)	Spinal anaesthesia	Stay in ward(Days)			
Thyroid	12 days	Fissure in ano	7 days			
Breast	12 days	Haemorrhoides	7 days			
Gynaecomastia	7 days	Fistula in ano	10 days			
Salivary glands	10 days	Varicose veins	10 days			
Incisional hernia	15 days	Inguinal hernia	8 days			
Appendicectomy	10 days	Appendicectomy	10 days			
Emergency	15 days	Hydrocele	7days			
(Laparotomy & proceed)						

Volume-6, Issue-2, February - 2017 • ISSN No 2277 - 8160

HRV Da	ta after surgical procedures.

General anaesthesia Spinal anaesthesiaVariableMean(SD)Mean(SD)p valueHR(1/min)72.4(13.1)72.1(13.0)0.78RR interval(msec)828(149)832(150)0.79

KKINTErval(MSec)	020(149)	852(150)	0.79
HRV Component	Mean (SD)	Mean(SD)	p value
RMSSD (ms)	26.3(16.3)	29.4 (27.8)	0.34
Total power (ms ²)	11.4(20.27	10.15(11.24)	0.37
%LF	58.6(16.0)	57.6(16.1)	0.21
%HF	42.3(16)	41.5 (15.3)	0.21
LF/HF	1.8(1.32)	1.77 (1.3)	0.32

DISCUSSION:-

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Several general surgeries were done under GA and some under SA. These groups may have different level of Surgical stress, inflammation, pain due to surgery and disease etc. In the present study, it is shown that the level of stress at the time of discharge remains similar. It is well known that the patients who are put on GA may have higher stress post operatively compared to SA. This present study indicates stress in the group of patients are similar. The skill of surgery, management of post-operative infections, reduction of inflammation during post operative management are some of the contributory factors to keep the stress in patients at lower level.

Earlier studies tried to quantify the post-operative pain and stress with HRV. Ledowski et al (2013) used visual analogue scale (VAS) or numerical rating scale (NRS) and analgesia nociception index (ANI) which depends on HRV as a surrogate pain measure. They concluded that ANI did not reflect post-operative pain. Whereas, Boselli etal (2013) could identify that ANI appears to be simple and non invasive measurement in post operative analgesia and further suggested HRV dependent ANI can be useful in pediatric and geriatric patients critically ill or cognitively impaired patients and other patients who have difficulty in communication.

It has been demonstrated by Ledowski et al (2005) the relation between blood epinephrine, norepinephrine, ACTH, cortisol and HRV components during balanced anaesthesia (BAL) versus total IV anaesthesia (TIVA). They showed anaesthetic procedures influence the outcome of HRV parameters.

conclusion

In conclusion, in the present study, a comparative study on stress level between two groups of patients undergoing GA/SA, using HRV measurement as a tool was done. This study does not show any significant difference in stress level between the groups.

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