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Research Article

Comparative Evaluation Of Combined Use Of Intravenous Dexmedetomidine-Ketamine With Dexmedetomidine Alone Along With Peripheral Nerve Blocks For Split Skin Grafting From Lower Limbs In Adults

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Abstract

Split skin grafting is a minor surgical procedure involving transplantation of skin which can be carried out under topical, general, spinal anaesthesia or under controlled sedation. This study involves carrying out split skin grafting under controlled sedation using intravenous dexmedetomidine and ketamine along with peripheral nerve blocks and thereby providing a comparative evaluation of the combined use of dexmedetomidine and ketamine with dexmedetomidine alone. 50 patients planned for split skin grafting were randomly divided into two groups. Group DK received ketamine first at 0.8mg per kg over 1 minute followed by dexmedetomidine infusion at 0.3-0.5mcg per kg per hr. Group D received dexmedetomidine first at 1mcg per kg over 10 minutes followed by dexmedetomidine infusion at 0.3-0.5mcg per kg per hr. Pain was assessed based on movement, vocal response, tachycardia and hypertension. The combined use of dexmedetomidine and ketamine along with peripheral nerve blocks was found to provide adequate sedation and analgesia in patients undergoing minor surgical procedures like split skin grafting. Hemodynamic stability was maintained in the majority of the patients.

Keywords: Analgesia; Conscious sedation; Dexmedetomidine; Hemodynamic stability; Intravenous sedation; Ketamine; Minor surgical procedures; Multimodal analgesia; Pain assessment; Peripheral nerve block; Sedative combinations; Split skin grafting

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Introduction

Split skin grafts are composed of the epidermis and a superficial part of the dermis (**Prohaska & Cook., 2021**). Skin grafts are used in a variety of clinical situations, such as traumatic wounds, defects after oncologic resection, burn reconstruction, scar contracture release, congenital skin deficiencies, hair restoration, vitiligo and nipple-areola reconstruction (**Shimizu & Kishi., 2012**). Dexmedetomidine is a new generation highly selective α_2 adrenergic receptor agonist with a 1600:1 preference for α_2 receptors. Locus ceruleus of the brain stem is the principal site for the sedative action and spinal cord is the principal site for the analgesic action (**Kaur & Singh., 2011**). Its use is associated with sedative and analgesic sparing effects, reduced delirium and agitation, perioperative sympatholysis, cardiovascular stabilising effects and preservation of respiratory function. Ketamine is a cyclohexanone derivative that is rapidly acting and produces profound anaesthesia and analgesia (**Rosenbaum et al., 2021**). It has been widely used to provide analgesia in burn dressing changes, during excision and grafting and for sedation (**Kurdi et al., 2014**). This study was done to establish the comparative evaluation of combined use of intravenous dexmedetomidine with ketamine and dexmedetomidine alone, along with peripheral nerve blocks to provide adequate sedoanalgesia and maintain hemodynamic stability for patients undergoing minor surgical procedures like split skin grafting.

Material and Method

Approval of Institutional Ethical Committee and written informed consent was obtained from the patients before starting the study. 50 adults aged between 18-65 years of either gender undergone split skin grafting from the anterolateral aspect of thigh in supine position when the area of the harvesting/donor site required was less than

5 per cent with ASA grade I or II were included in the study and were randomly divided into two groups:- Dexmedetomidine + ketamine and Dexmedetomidine alone with 25 patients in each group. On arrival in the operation theatre, iv line was secured. Standard monitoring devices like pulse oximeter, non-invasive blood pressure device (NIBP), electrocardiogram (ECG) were attached and baseline recording of vital parameters was done. All patients received fentanyl at 1mcg per kg. Oxygen was delivered through venti mask at 5litres/min. Then, they were given an ultrasound guided femoral nerve block and lateral cutaneous nerve block with 10 ml of 0.25per cent bupivacaine for femoral block and 5ml of 0.25per cent bupivacaine for lateral cutaneous nerve block. The patients planned for split skin grafting were randomly divided into two groups. Randomisation was done by the computer generated randomisation method based on sealed envelopes technique. Group DK received ketamine first at 0.8mg per kg over 1 minute followed by dexmedetomidine infusion at 0.3-0.5mcg per kg per hr. Group D received dexmedetomidine first at 1mcg per kg over 10 minutes followed by dexmedetomidine infusion at 0.3-0.5mcg per kg per hr. Pain was assessed based on movement, vocal response, tachycardia and hypertension.

In case the patient complained of pain or there was increase in the heart rate by 20per cent above baseline, fentanyl was repeated at 0.5mcg per kg twice. If the pain still persisted, the patient was administered general anaesthesia involving Laryngeal Mask Airway(LMA) insertion with propofol to loss of verbal response and atracurium at 0.5mg per kg body weight.

Sedation was assessed by Ramsay sedation score. Ramsay Sedation Scale (**Ramsay et al., 1974**).

Pain and sedation were also assessed by Visual Analog Scale based on the surgeon's observation classified as poor or satisfactory or excellent.⁷

Result and observation

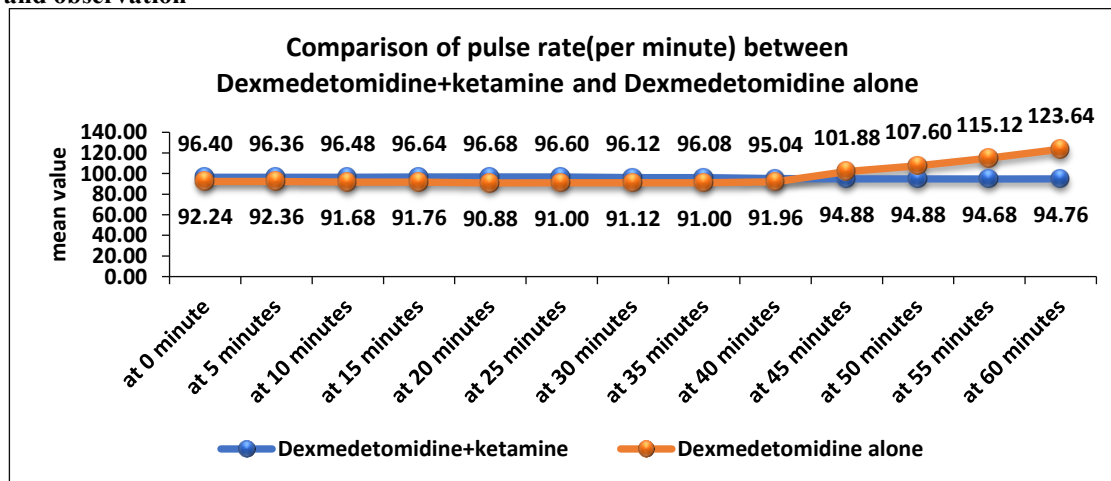


Figure 1:-Comparison of trend of pulse rate(per minute) at different time intervals between Dexmedetomidine + ketamine and Dexmedetomidine alone.

Mean $\pm$ SD of pulse rate(per minute) at 50 minutes, at 55 minutes, at 60 minutes in dexmedetomidine alone was 107.6 ± 19.24 , 115.12 ± 19.66 , 123.64 ± 21.06 respectively which was significantly higher as

compared to dexmedetomidine + ketamine (94.88 ± 15.54 (p value=0.013), 94.68 ± 15.55 (p value=0.0002), 94.76 ± 16.07 (p value<.0001)) respectively.

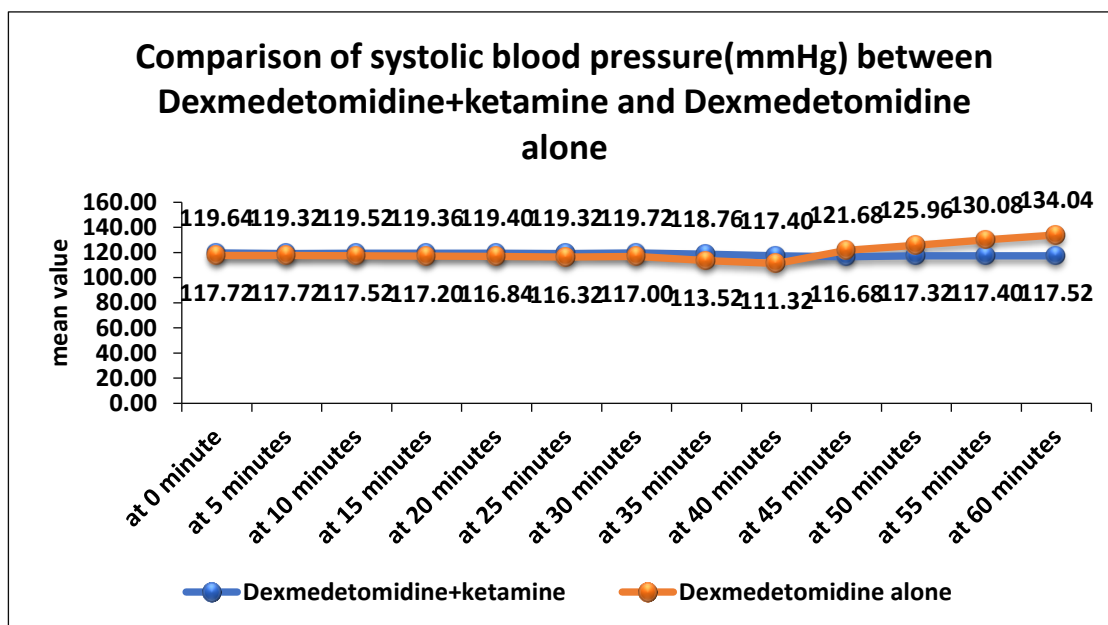


Figure 2:-Comparison of trend of systolic blood pressure(mmHg) at different time intervals between Dexmedetomidine + ketamine and Dexmedetomidine alone.

Mean $\pm$ SD of systolic blood pressure(mmHg) at 50 minutes, at 55 minutes, at 60 minutes in dexmedetomidine alone was 125.96 ± 16.06 , 130.08 ± 16.5 , 134.04 ± 16.76 respectively which was significantly higher as compared to dexmedetomidine + ketamine (117.32 ± 11.89 (p value=0.036), 117.4 ± 11.24 (p value=0.003), 117.52 ± 10.73 (p value=0.0002)) respectively.

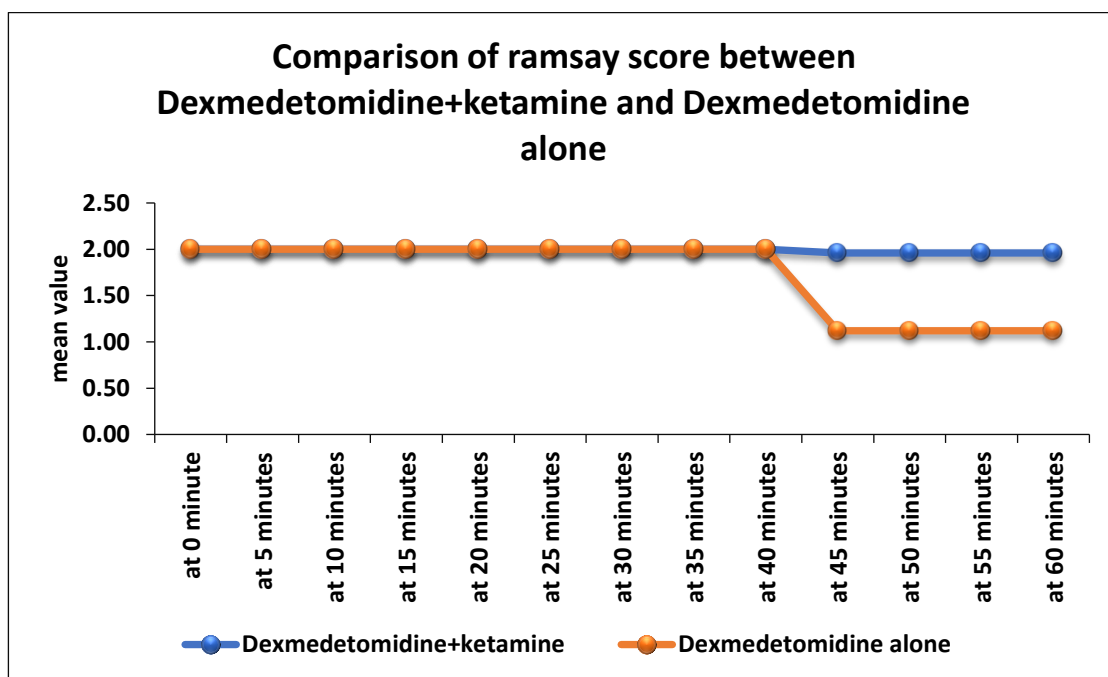


Figure 3:-Comparison of trend of ramsay score at different time intervals between Dexmedetomidine + ketamine and Dexmedetomidine alone.

Mean $\pm$ SD of ramsay score at 45 minutes, at 50 minutes, at 55 minutes, at 60 minutes in dexmedetomidine + ketamine was 1.96 ± 0.2 , 1.96 ± 0.2 , 1.96 ± 0.2 , 1.96 ± 0.2 respectively which was significantly higher as compared to

dexmedetomidine alone (1.12 ± 0.33 (p value < .0001), 1.12 ± 0.33 (p value < .0001), 1.12 ± 0.33 (p value < .0001), 1.12 ± 0.33 (p value < .0001)) respectively.

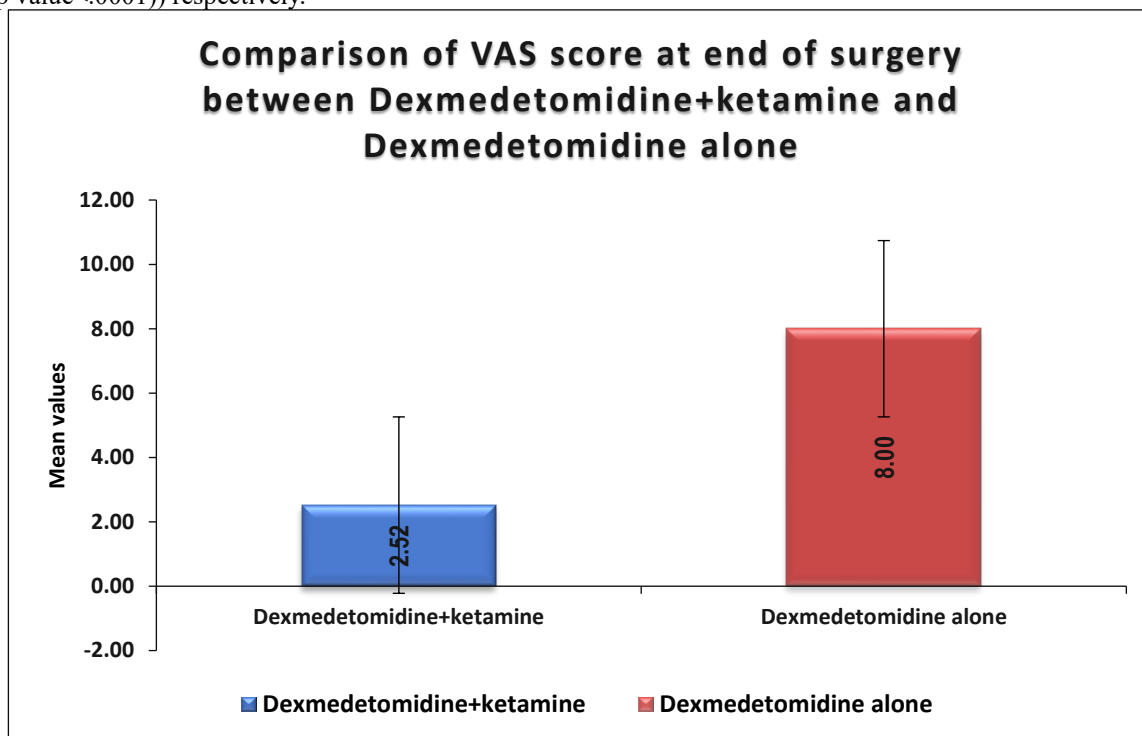


Figure 4:-Comparison of VAS score at end of surgery between Dexmedetomidine + ketamine and Dexmedetomidine alone.

Mean $\pm$ SD of VAS score at end of surgery in dexmedetomidine alone was 8 ± 2.42 which was significantly higher as compared to dexmedetomidine + ketamine (2.52 ± 1.45). (p value < .0001).

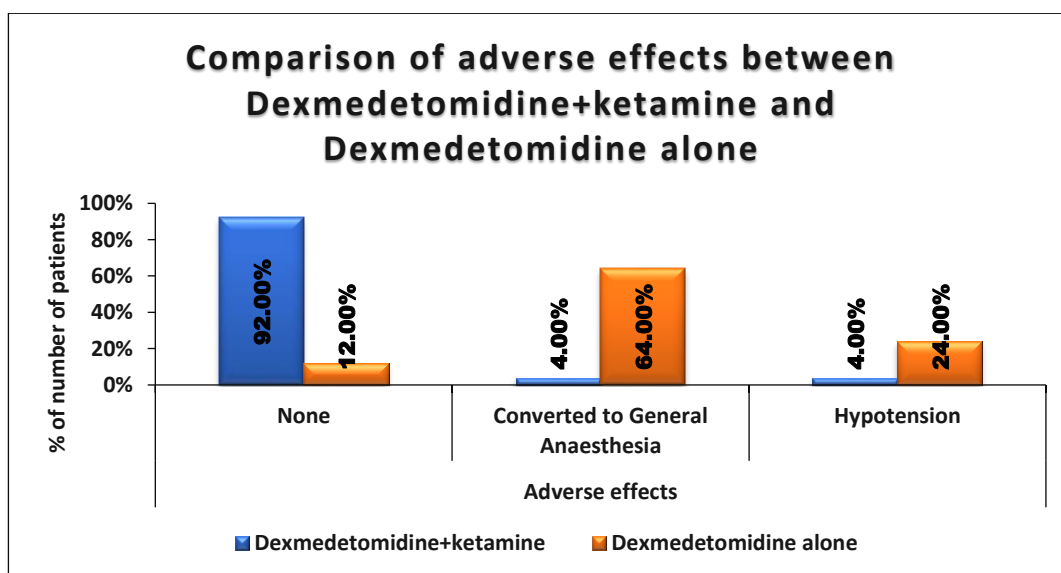


Figure 5:-Comparison of adverse effects between Dexmedetomidine + ketamine and Dexmedetomidine alone.

Proportion of patients with adverse effects:- converted to General Anaesthesia, hypotension was significantly lower in dexmedetomidine + ketamine as compared to dexmedetomidine alone. (Converted to General Anaesthesia:- 4% vs 64% respectively, Hypotension:- 4% vs 24% respectively). (p value < .0001).

Discussion

Dexmedetomidine is a selective alpha 2 adrenergic receptor agonist used for sedation and analgesia. It results in cooperative sedation and mimics natural sleep. Ketamine is a NMDA and glutamate receptor antagonist

which has been widely used for sedation and analgesia. When used together, dexmedetomidine and ketamine may provide effective sedoanalgesia while maintaining hemodynamic stability. Cardiostimulatory effects of ketamine counters the bradycardia and hypotension

caused by dexmedetomidine whereas tachycardia, hypertension and emergence delirium caused by ketamine are reduced by the sedative action of dexmedetomidine and the reduced dose of ketamine required for sedation. Ketamine also results in a faster onset of action as compared to isolated use of dexmedetomidine.

Ramsay sedation score 1.96 ± 0.2 (Mean $\pm$ SD) representing calm, cooperative patients with adequate sedation was obtained in the majority of the patients undergoing split skin grafting who received a combination of dexmedetomidine along with ketamine (GROUP DK)⁶. Effective sedation was achieved in all the patients except one patient. VAS score of 8 ± 2.42 (Mean $\pm$ SD) was recorded at the end of surgery (Haefeli & Elfering., 2006).

On the other hand, Ramsay sedation score 1.12 ± 0.33 (Mean $\pm$ SD) representing anxious, agitated patients with inadequate sedation was observed in patients who received dexmedetomidine alone (GROUP D). 22 patients in the group required additional fentanyl along with general anaesthesia for the continuation of the procedure. Singha et al studied the efficacy of the combined use of dexmedetomidine along with ketamine for minor surgical procedures like split skin grafting and found that effective sedation and analgesia was achieved during the surgery (Singha et al., 2016).

Sinha et al found that the combined use of dexmedetomidine with ketamine provided better hemodynamic stability and sedation than dexmedetomidine alone for fiberoptic nasotracheal intubation (Sinha et al., 2014).

SUMMARY AND CONCLUSION

This study evaluated the efficacy and safety of intravenous dexmedetomidine and ketamine, in combination with peripheral nerve blocks, for controlled sedation in patients undergoing split skin grafting. Fifty patients were randomly divided into two groups: Group DK received ketamine followed by dexmedetomidine infusion, while Group D received a dexmedetomidine loading dose followed by a maintenance infusion. Pain assessment was conducted using parameters such as patient movement, vocal response, tachycardia, and hypertension. The combination of dexmedetomidine and ketamine (Group DK) provided superior sedation and analgesia compared to dexmedetomidine alone (Group D). Most patients maintained hemodynamic stability throughout the procedure, with minimal adverse effects noted. In conclusion, the combined use of dexmedetomidine and ketamine, along with peripheral nerve blocks, is a safe and effective approach for providing adequate sedation and analgesia in minor surgical procedures such as split skin grafting. This combination not only enhances patient comfort but also contributes to improved intraoperative stability and procedural success.

The combined use of dexmedetomidine and ketamine along with peripheral nerve blocks was found to provide adequate sedation and analgesia in patients undergoing

minor surgical procedures like split skin grafting.

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