Effect of topical melatonin 10% on the healing of infected wounds after surgery

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ABSTRACT

Melatonin remarkably accelerates wound healing in full-thickness incisional wounds. The present study aims to examine the possible antibacterial effect of topical melatonin against wound infection after surgery. Fifty-nine patients had wound infection after surgery were included in this study. One gram of tissue culture contains more than $10^5$ colonies/gram where investigated. The culture was done after five days of surgery. Two types of bacteria were isolated; Streptococcus and Staphylococcus species. Three groups included in this study. Conventional therapy group (Fucidin 2% ointment) was considered negative control group, local melatonin 10% group, which was regarded as a positive control group and combination group of conventional therapy and local melatonin 10% groups. Treatment duration was six days; The majority hard work has been conducted to improve the antimicrobial actions of a wide range of topically used therapeutic agents, to ensure disinfection in wound sites, also, to increase wound healing processes and tissue regeneration mechanisms. The most significant cause for the manifestation and distribution of strains of bacteria which have resistant is the overuse of antibacterial drugs which initiate look for agents that may have antibacterial actions. Combination therapy gives 100% cured cases. This may be attributed to a synergistic effect between conventional treatment and melatonin therapy; therefore, the present study is to investigate the possible antibacterial effect of topical melatonin (10%) against wound infection after surgery.

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INTRODUCTION

Melatonin is formed by the pineal gland and further organs, including the retina, gastrointestinal tract, and skin (Acuña-Castroviejo et al., 2014). Melatonin has extensive neuroprotective, antioxidant, and anti-inflammatory properties (Paredes et al., 2007; Park et al., 2010). Melatonin markedly accelerates wound repair (Pugazhenthil et al., 2008). The radical scavenging actions of melatonin have been broadly recognized both in vitro and in animal studies (Gitto et al., 2001; Yeung et al., 2015). It plays vital roles in many functions like sleep and circa-
dian rhythm regulation (Bourne and Mills, 2006), immunomodulation (Santello et al., 2008), analgesia (Gitto et al., 2011), anti-fibrosis (Hu et al., 2016), anti-apoptosis (Liu et al., 2015) and endoplasmic reticulum homeostasis. Melatonin may contribute to the management of pathogen infections due to viruses (Tan et al., 2014), parasites (Laranjeira-Silva et al., 2015) and bacteria. Melatonin is a powerful antioxidant and anti-inflammatory and to have defensive actions against sepsis and multiple organ failure (Reiter et al., 2016).

Melatonin found to have an essential role in diabetic wound healing in previous in vitro study. Melatonin decreased the mRNA expression and the release of pro-inflammatory cytokine in keratinocytes under high levels of glucose. High glucose-induced activation of nucleotide-binding and oligomerization domain-like receptor family pyrin domain-containing 3 (NLRP3) inflammasome was inhibited via melatonin therapy. Melatonin led to increased proliferation and migration in addition to its ability to decrease the apoptosis of keratinocytes which were mediated via extracellular signal-regulated kinase ERK signalling (Song et al., 2016).

Aim of the study

The purpose of the present study is to investigate the possible antibacterial effect of topical melatonin (10%) against wound infection after surgery.

PATIENTS AND METHODS

Fifty-nine patients, their age between 1-4 years, all of them have wound infection after surgery. One gram of tissue culture contains more than $10^5$ colony/gram where investigated. The culture was done after five days of surgery. Two types of bacteria were isolated; Streptococcus and Staphylococcus species. Three groups included in this study. Conventional therapy group (Fucidin 2% ointment) which, considered as the negative control group, local melatonin 10% group, which was regarded as the positive control group and combination group of conventional therapy and local melatonin 10% groups. Treatment duration was six days.

RESULTS AND DISCUSSION

Fifty-nine patients, 34 male (57.62%) and 25 female (42.36%) were included in the study (Figure 1). Two types of bacteria were isolated; Streptococcus (45.76%) and Staphylococcus (55.93%) species (Figure 2). The clinical manifestations of wound infection after surgery were redness, swelling, heat, pain and fever as shown with their percentage in

Figure 1: % of male and female in the study

Figure 2: % of Streptococcus and Staphylococcus species isolated

Figure 3: The clinical manifestations of wound infection

Figure 4: Effect of administration of conventional therapy to patients had wound infection caused by Streptococcus species
Figure 5: Effect of administration of melatonin 10% therapy to patients had wound infection caused by Streptococcus species

Figure 6: Effect of combination therapy on the healing of the wound infection caused by Streptococcus species

Figure 7: Effect of administration of conventional therapy to patients had wound infection caused by Staphylococcus species

Figure 8: Effect of administration of melatonin 10% therapy to patients had wound infection caused by Staphylococcus species

Figure 9: Effect of combination therapy on the healing of the wound infection caused by Staphylococcus species

In case of wound infection by Streptococcus species, combination group showed 100% cured when compared with conventional therapy (66.66%) cured and melatonin group (50%) cured cases. Melatonin group showed no cases of worse infection when compared with conventional therapy which showed (11.11%) worse cases (Figure 4, Figure 5, Figure 6). In case of wound infection by Staphylococcus species, combination group showed 100% cured when compared with conventional therapy (77.77%) cured and melatonin group (86.66%) cured cases (Figure 7, Figure 8, Figure 9).

Surgical intervention might be coupled with surgical site infection (SSI). SSI may range from merely controllable cases to severe life-threatening state. SSI remains one of the significant healthcare-associated infections resulting in pain, and extended hospital stay with enhanced costs, cosmetically undesirable scars (Bayat, 2003). Staphylococcus aureus is the dominant microorganism implicated in SSI (Mangram et al., 1999; Dai et al., 2010; Sevgi et al., 2014).

The most significant cause for the manifestation and distribution of strains of bacteria with have resistant is the overuse of antibacterial drugs which initiate look for agents that may have antibacterial actions (Abdalkader and Saedi, 2020). Melatonin is approved by the U.S. Food and Drug Administration and extensively used in clinical practice. SSI is the mainly widespread healthcare-related infection that might be decreased by antibiotics prophylaxis against the possible offending organisms (Kelso et al., 2011).
In the present study, combination therapy gave 100% cured cases; this may be attributed to a synergistic effect between conventional therapy and melatonin therapy. In the case of wound infection by Streptococcus species, the combination group showed 100% cured when compared with conventional therapy (66.66%) cured and melatonin group (50%) cured cases. Melatonin group showed no instances of worse infection when compared with conventional therapy which showed (11.11%) worse cases.

In case of wound infection by Staphylococcus species, combination group showed 100% cured when compared with conventional therapy (77.77%) cared and melatonin group (86.66%) cured cases, so melatonin showed a superior percentage of wound healing when compared to traditional therapy. In vivo research performed by using melatonin in infectious disease, models recognized it as a successful treatment (Tekbas et al., 2008). Melatonin prevents the uptake of the Linoleic acid by malignant cells that decreases the activation of genes which encourage cell proliferation (Blask et al., 2005); Related actions of melatonin on the bacterial wall may occur therefore limit the survivability of bacteria. Moreover, melatonin has an elevated metal-binding ability. Bacteria are strongly reliant on free metals, especially free iron for growth. Melatonin's anti-inflammatory and anti-apoptotic actions may decrease the degree of mucosal damage. Since melatonin without difficulty passes all biological barriers as well as bacterial cell wall, it can attach free iron in the cytoplasm and limit bacterial growth through this mechanism (Hatem et al., 2011; Gulcin et al., 2003).

CONCLUSION

Topical melatonin(10%) application resulted in a good percentage of healing in wound infection caused by Streptococcus species and Staphylococcus species and the combination of topical conventional therapy with topical melatonin (10%) therapy resulted in 100% cured in wound infection cases.

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Ethical Clearance

The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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