Sub-Flap Use of Nano-Selenium Oxide Solution Enhances Skin Flap Viability in Rats: Study the Novel Role of mTOR and p-mTOR Expression

Summary: Nano-selenium oxide (NSeO) particles are highly noticeable due to their tissue-protective and antioxidant properties. For this purpose, the effect of NSeO was evaluated on skin flap survival and flap oxidative stress markers in rats. Also, another effect of NSeO was investigated on the expression of mTOR and p-mTOR.

Methods-Results: Fifty rats were divided into five groups of ten. Skin flap size was 3×8 cm in all groups. Groups were: (1) Sham, (2) Flap Surgery group, (3) Flap Surgery + NSeO, (4) Flap Surgery + Rapamycin (mTOR inhibitor), (5) Flap Surgery + Rapamycin + NSeO. The flap necrosis rate was computed using the paper pattern method on day seven after surgery. After day seven, flap tissues were collected for histological evaluations. Then, malondialdehyde (MDA) content and superoxide dismutase (SOD) activity were measured. Furthermore, the expression levels of mTOR and p-mTOR were measured using the Western blot method. Treatment with NSeO significantly reduced necrosis ($P<0.05$). It also resulted in a decrease in MDA level ($P<0.05$). Histologically, NSeO reduced inflammation and increased positive signs of tissue healing (epithelialization, neovascularization, fibroblast migration, and granulation tissue). NSeO increased SOD activity significantly ($P<0.05$), whereas, using rapamycin reversed these effects. Also, in all groups, mTOR changes were not significant. Additionally, p-mTOR expression was significantly reduced in groups that rapamycin was injected.

Conclusion: NSeO can reduce flap necrosis and enhance tissue healing in rats. So, it can potentially be used clinically to promote tissue repair significantly, and its effects are independent of the mTOR pathway.