Effects of Gut Microbiome Diversity on Postoperative Complications in Polytrauma Patients

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Purpose: Postoperative complications in trauma patients occur with relative frequency. It is not always clear why a patient develops complications. Risk factors, like smoking, are known to increase the risk of complications; however, not everyone who smokes develops a complication. Likewise, patients without any known risk factors also develop complications. An explanation may lie with the gut biome, which has been shown in other medical specialties to affect both mental/physical health and complications. While recent literature has demonstrated detrimental and beneficial links between the gut biome and certain orthopaedic conditions, no literature examines its link to postoperative complications in trauma patients. This prospective observational study examines differences in the gut microbiome in orthopaedic trauma patients who develop postoperative complications, compared to those who do not.

Methods: Patients over 18 who presented as a trauma activation with orthopaedic injuries were enrolled preoperatively. At the time of initial orthopaedic surgical intervention, a fecal swab was collected, with a second sample obtained prior to discharge. A total of 25 patients were enrolled, 17 of whom provided paired samples. Patients were monitored for complications including deep infection, wound healing delays, reoperations, and nonunions. Primary outcome was microbiome diversity based on 16S rRNA sequencing and presence of postoperative complications. Data were analyzed using PERMANOVA (permutational multivariate analysis of variance) with Jaccard distances and serial t-tests. Statistical significance was set at $P<0.05$.

Results: 11 of 17 patients with paired samples developed complications postoperatively. Two-way PERMANOVA detected a significant difference in overall composition (beta-diversity) between individuals who developed complications versus those that did not ($P = 0.0004$). Several bacterial taxa were enriched in patients with or without complications including members of Lachnospiraceae and Peptostreptococcaceae, respectively, among others.

Conclusion: Trauma patients with a less diverse gut biome, and higher concentrations of certain bacterial taxa, are at higher risks of developing postoperative complications.