



*Mini Review*

**IMPACT OF STRESS RELATED\_HYPERGLYCEMIA ON  
THE RECOVERY OF PATIENT WITH FEMORAL NECK FRACTURE**

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**ABSTRACT**

**Summary:** The growing epidemic of type 2 diabetes and the preceding metabolic conditions play an important role in the perioperative period in trauma patients.

**Aim:** The aim of this research is to follow-up patients with stress related hyperglycemia and femoral neck fracture and to propose effective strategies for optimization of medical and health care.

**Materials and methods:** The methods employed in the study were analyses of medical documentation and para clinical studies. Retrospective research was performed in the period of September 2023 - January 2024, based on clinical data of twenty patients (n=20) with fractures of coli femoris and stress-related hyperglycemia, before and after surgical intervention for the fracture at the Clinic of Orthopedics and Traumatology in the General Hospital for Active Treatment “St. Anna” - Varna.

**Conclusion and Results:** The study clearly demonstrates the significant impact of stress-related hyperglycemia on patients with femoral neck fracture, particularly those with pre-diabetic conditions and undiagnosed type 2 diabetes.

The implementation of these strategies has the potential to improve the clinical outcomes and quality of life for patients by reducing the risk of complications and the length of hospital stay.

**Key words:** type 2 diabetes, fractures of coli femoris

**INTRODUCTION**

According to the World Health Organisation, to this date, more than 420 million people are living with diabetes worldwide. This number is expected to rise to 578 million by 2030 and 700 million by 2045. There are increasing numbers of people living with diabetes and a severe lack of prevention of risk factors related with the disease (1). According to Zhang et al. who performed a meta-analysis, diabetes can significantly impact the perioperative complications, hospitalization and survival rate. Diabetes is a risk factor for postoperative infections, increased risk of bleeding, risk of complications during surgical wound healing, renal failure, reoperation, rehospitalization and death after orthopedic surgery (2).

The glyceimic management during hospitalization aims to avoid hyperglycemia and hypoglycemia. Randomized studies of hospitalized patients show that optimal glyceimic management is associated with improved perioperative outcomes. During periods of increased stress (surgery, sepsis and infection), insulin is the method of choice to achieve glyceimic control, even in patients who have not used insulin prior to admission. In some cases, requirements are significantly increased due to stress-related hyperglycemia (3).

The growing epidemic of type 2 diabetes and the preceding metabolic conditions play an important role in the perioperative period in trauma patients. Lower body trauma can lead to a physiological reaction of stress responses and damage to insulin-producing beta-cells, negatively impaction glucose homeostasis.

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**AIM** The aim of this research is to follow patients with the above-mentioned pathology and to propose effective strategies for the optimization of medical and health care.

### **MATERIAL AND METHODS**

Retrospective research was performed in the period of September 2023 - January 2024, based on clinical data of twenty patients (n=20) with fractures of colli femoris and stress-related hyperglycemia, before and after surgical intervention for the fracture at the Clinic of Orthopedics and Traumatology in the General Hospital for Active Treatment "St. Anna" - Varna. The methods employed in the study were analyses of medical documentation and para clinical studies.

### **RESULTS AND DISCUSSION**

The results of the clinical follow-up shows that a higher proportion of the included patients were females aged between 75-85 years, and a few aged between 65-74 years.

Most of the patients had already developed type 2 diabetes, and the other part matched the profile of prediabetic state and presence of insulin resistance with compensatory hyperinsulinemia.

Summary of the laboratory parameters in the perioperative period were as follows:

- Elevated fibrinogen levels;
- Abnormal uric acid metabolism;
- Elevated C-reactive protein;
- Elevated triglyceride levels above 1,7 mmol/l;
- Low HDL (high density lipoprotein) levels;
- Visceral obesity;
- Abnormal fasting glycemia;
- More frequent night urination.

Almost half of the patients (42%) with undiagnosed type 2 diabetes with a pre-diabetic condition, were admitted to the hospital (between 6-12 o'clock after the trauma, without food consumption) with glucose level above 11 mmol. When measured the next day, after fasting the glucose level (blood sugar level) ranged between 7-8 mmol, which indicates the relation between trauma and stress. Cardiovascular and renal complications during the hospitalization were 22% more common in patients with inadequate glycemic control.

Nearly one third of the observed patients (32,71%) were obese and had high BMI (body mass index), 3,71% of them were with BMI over 31.

It was noticed that 68% of the patients had difficulties in rehabilitation activities due to being overweight, easy fatigability, altered mental status, saver irritability, lethargy and confusion.

In a small percentage of the patients (4,31%) diagnosed with type 2 diabetes, it was observed that patients felt more pain in the hip joint after the surgery and needed pain relief in a smaller period of time.

The surgery and the anesthesia induced a stress response that leads to significant neuro physical changes with release of adrenaline, noradrenaline, cortisol, glucagon and growth hormones. This increase in counterregulatory hormones and cytokines elevates the glucose level and increases the insulin resistance. In susceptible patients, this can lead to significant hyperglycemia (4).

Components of the surgical process, such as disturbed eating habits due to fasting or postoperative nausea, skipping insulin or hypoglycemic medications, and complications, can lead to disrupted glucose homeostasis in the perioperative period (5).

All of the followed-up results led us to summarize the following effective strategies.

- Consistent and permanent perioperative glycemic control to avoid hypoglycemia, severe hyperglycemia, electrolyte disturbances and diabetic emergencies (6).
- Avoiding prolonged fasting. It can lead to increased insulin resistance in patients with or without diabetes. Higher insulin resistance is associated with poor wound healing, higher complications risk and prolonged hospital stay. The amount of insulin resistance is more severe in larger or more complex surgery and those with greater blood loss (7).
- To prevent the development of decubitus. The decubitus is an issue in the surgical field, causing pain, reduced quality of life and prolonged hospital admission. Diabetes can increase the risk of its occurrence up to 3 times compared to healthy patients. (8)
- Proper dosage and administration of antibiotics. Different pharmacodynamic and pharmacokinetics of antibiotics related with morbid obesity, makes their efficiency less predictable. Obesity is associated with increased rates of surgical site infection and studies by Dowsey and Choong show that

this is an independent risk for periprostheses infection of both the hip and knee. (9,10)

- Insulin infusions should continue until the patient starts taking food. When restarting the usual insulin treatment, the subcutaneous insulin dose should be administered 30 min before discontinuing the intravenous infusion, to minimize the risk of hyperglycemia and glucose abnormalities. (5).

We can therefore conclude that patients with good glycemic control have no difference during the hospital stay and complications in the postoperative period compared to patients without metabolic disorder. Many of the observed patients present more than one risk factor for developing type 2 diabetes, and are referred for monitoring after discharge.

The study clearly demonstrates the significant impact of stress-related hyperglycemia on patients with femoral neck fracture, especially those with prediabetic conditions and undiagnosed type 2 diabetes. Elevated blood glucose levels induced by trauma and stress are associated with a higher risk of cardiovascular and renal complications, especially in patients with inadequate glycemic control. In addition, obesity and high body mass index make rehabilitation activities more difficult, leading to increased fatigue and other mental and physical problems.

The observed difficulties in pain management and the need for more frequent analgesia in patients with type 2 diabetes highlights the additional challenges in the perioperative period. Surgical intervention and anesthesia induce a stress reaction, which leads to significant hormonal and metabolic changes, that increase glucose levels and insulin resistance.

## CONCLUSION

Based on the analysis, several strategies for the optimization of medical and health care were outlined, including:

- Consistent perioperative glycemic control.
- Avoidance of prolonged fasting.
- Prevention of decubitus.
- Proper antibiotic dosing.
- Continuing insulin infusions until the patient starts taking food.

The implementation of these strategies has the potential to improve the clinical outcomes and quality of life for patients by reducing the risk of complications and length of hospital stay.

## REFERENCES

1. Reducing the burden of noncommunicable diseases through strengthening prevention and control of diabetes, Seventy-fourth world health assembly, available from <https://www.who.int/health-topics/diabetes>
2. Zhang, X., et al. (2022). Association of Diabetes Mellitus with Postoperative Complications and Mortality After Non-Cardiac Surgery: A Meta-Analysis and Systematic Review. *Front Endocrinol (Lausanne)*. 2022 May 26;13:841256. doi: 10.3389/fendo.2022.841256. PMID: 35721703; PMCID: PMC9204286.
3. Wukich, K. (2015). Diabetes and its negative impact on outcomes in orthopaedic surgery. *World J Orthop*. 2015 Apr 18;6(3):331-9. doi: 10.5312/wjo.v6.i3.331. PMID: 25893176; PMCID: PMC4390895.
4. Dortch, D., Eck, L., Ladlie, B., et al. (2000). Peri-operative glycemic control in plastic surgery: review and discussion of an institutional protocol. *Br J Anaesth*. 2000;85(1):109-17. doi: 10.1093/bja/85.1.109.
5. Akiboye, F., Rayman, G. (2017) Management of Hyperglycemia and Diabetes in Orthopedic Surgery. *Curr Diab Rep*. 2017 Feb;17(2):13. doi: 10.1007/s11892-017-0839-6. PMID: 28265893; PMCID: PMC5339317.
6. Finfer, S., Chittock, DR, Su, SY-S. (2009) NICE-SUGAR Study Investigators et al. Intensive versus conventional glucose control in critically ill patients. *N Engl J Med*. 2009; 360:1283-97. doi: 10.1056/NEJMoa0810625.
7. Ljungqvist, O., Soop, M., Hedström, M. (2007). Why metabolism matters in elective orthopedic surgery: a review. *Acta Orthop*. 2007; 78:610-5.
8. Lumbley, L., Sa A., Tchokouani, L.S. (2014). Retrospective review of predisposing factors for intra-operative pressure ulcer development. *J Clin Anesth*. 2014;26(5):368-74. doi: 10.1016/j.jclinane.2014.01.012.
9. Dowsey, M., Choong, PF. (2009). Obese diabetic patients are at substantial risk for deep infection after primary TKA. *Clin Orthop Relat Res*. 2009;467(6):1577-81. doi: 10.1007/s11999-008-0551-6.
10. Dowsey, M., Choong, PF. (2008) Obesity is a major risk factor for prosthetic infection after primary hip arthroplasty. *Clin Orthop Relat Res*. 2008;466(1):153-8. doi: 10.1007/s11999-007-0016-3.