

Insulinoma

Risk

- Most common functional islet cell tumor of pancreas
- Incidence: 1–4 per million population per year
- Mean age of onset: 47 y
- Presentation earlier (mean age 25 y) if part of MEN-1
- More common in females

Perioperative Risks

- Hypoglycemia

Worry About

- Preop and intraoperative hypoglycemia
- Post-excision rebound hyperglycemia (not always present and not reliable to validate completeness of resection)
- Possibility of multiple islet cell tumors or MEN-1 characterized by primary hyperparathyroidism, anterior pituitary adenomas, and tumors of the pancreas and duodenum

Overview

- 80–90% are <2 cm, solitary, and benign.
- Malignant lesions typically invade locally into surrounding structures or into the lymph nodes or liver
- Insulinomas are found equally distributed throughout the pancreas (i.e., head, body, and tail).
- 5–10% occur in the setting of MEN-1; increased risk of recurrence if associated with MEN-1.
- Presentation: Post-absorptive hypoglycemia, hypoglycemia after exercise, awakening at night to eat, and weight gain due to frequent meals to avoid hypoglycemic symptoms.
- Differential Dx: Factitious hypoglycemia, liver or metabolic disease, NIPHS.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
RENAL	Renal stones if MEN-1	Renal colic	Flank pain	Serum Ca ²⁺
ENDO	MEN-1 Pituitary tumors Insulinoma	Renal colic Vision changes Neurogenic symptoms: Hunger, sweating, and paresthesias (cholinergic) and anxiety, tremor, and palpitations (adrenergic) Neuroglycopenic symptoms: behavioral changes, death, confusion, vision changes, fatigue, seizure, loss of consciousness	Flank pain Signs of pituitary dysfunction Mental status exam	Parathyroid hormone, serum Ca ²⁺ Skull x-rays and appropriate endocrine tests Fasting glucose, insulin levels, C-peptide
CNS	Symptoms of hypoglycemia	Neuroglycopenic symptoms	Mental status exam	Blood glucose

Key References: Mathur A, Gorden P, Libutti S: Insulinoma, *Surg Clin North Am* 89(5):1105–1121, 2009; Goswami J, Somkuwar P, Naik Y: Insulinoma and anaesthetic implications, *Indian J Anaesth* 56(2):117–122, 2012.

Perioperative Implications

Preoperative Preparation

- Maintain/optimize physiologic condition.
- Evaluate for MEN-1.
- Avoid severe hypoglycemia with frequent meals and avoidance of prolonged exercise.
- Diazoxide, octreotide, and verapamil to control hypoglycemia if necessary; should be continued the morning of surgery.
- Admit the night before and maintain on 10% dextrose infusion while NPO.
- Remove dextrose from IV solution just prior to entering the operative room.
- Monitor plasma glucose every 10–15 min.

Monitoring

- Measure plasma glucose every 10–15 min.
- Maintain plasma glucose >60 mg/dL.
- Consider arterial line and/or CVP to facilitate sampling ease.

Airway

- Nothing specific, although these pts may have significant weight gain.

Induction

- Propofol has not been shown to significantly affect the release of insulin or glucose regulation.

Maintenance

- Length of procedure highly variable.
- Careful attention to fluid status.
- Have dextrose solutions available to treat hypoglycemia.
- Goal should be to decrease cerebral metabolic rate.

Extubation

- Nothing specific

Anticipated Problems/Concerns

- It has been proposed that glucose solutions be avoided intraoperatively so that hyperglycemic rebound can be used to confirm tumor removal.

Etiology

- Unknown; most are solitary adenomas.
- 5–10% of insulinomas associated with the autosomal dominant MEN-1 syndrome; the gene causing MEN-1 is localized in band 11q13.

Usual Treatment

- Operative management is only curative option.
- Surgery includes inspection of the entire abdomen for evidence of metastatic disease, palpation of the entire pancreas and intraoperative US to localize the lesion.
- Laparoscopic enucleation is the treatment of choice for all benign insulinomas.
- Enucleation may be performed for lesions that are clearly localized preoperatively, near or at the pancreatic surface, and easily defined intraoperatively.
- Resection recommended for lesions that are multiple, near the pancreatic duct or major vessels, MEN-1 cases, and suspected malignancy (infiltrating tumor, puckering of surrounding soft tissue, distal dilation of pancreatic duct, or lymph node involvement).
- Medical management is reserved for those who are awaiting surgery, not a surgical candidate or have persistent symptoms despite surgery.
- Medical treatment consists of small frequent meals, diazoxide, verapamil, and octreotide.
- Octreotide is a somatostatin analogue that can relieve symptoms in 50% of pts.
- Octreotide should be used with caution because many insulinomas lack octreotide receptors. Treatment may fail to suppress insulin production and blunt compensatory growth hormone and glucagon response, leading to worsening hypoglycemia.

- More recent studies show that less than half of pts will have this rebound in the first 30 min following tumor removal, and therefore hyperglycemic rebound cannot be used as proof of complete tumor removal.
- Intraoperative handling of the tumor may cause severe hypoglycemia.
- Pneumoperitoneum during laparoscopy causes release of cortisol which stimulate glucose production.
- Intraoperative insulin assays may be an alternative.
- Pts who have hyperglycemic rebound and/or successful tumor removal can still have hypoglycemic episodes, so pts must be monitored for hypoglycemia in the postop period.
- Most patients are discharged home with normal fasting glucose levels.
- Postop complications include pancreatic duct leak causing pseudocyst, abscess, and/or fistula (octreotide can be used to decrease fistula output).