ers.com, for detailed information on anesthesia books, visit our website www.jaypeebrothers.com, for detailed information on anesthesia books

Handbook of CLINICAL ANESTHESIA

A Case-based Approach



Editors
Chavi Sethi
Amrita Gupta

Forewords
Pradeep Sahi
Uma Srivastava

JAYPEE

Contents

SECTION 1: Endocrine System

1. **Pheochromocytoma** 3
   Amrita Gupta
2. **Diabetes Mellitus** 17
   Amrita Gupta
3. **Thyroid Swelling** 35
   Amrita Gupta

SECTION 2: Genitourinary System

4. **Transurethral Resection of Prostate** 59
   Amrita Gupta
5. **Intestinal Obstruction and Enhanced Recovery after Surgery** 76
   Amrita Gupta

SECTION 3: Reproductive System

6. **Obstetric Hemorrhage and Anesthesia** 93
   Chavi Sethi
7. **Hypertensive Disorders of Pregnancy** 143
   Chavi Sethi
8. **Surgery in a Pregnant Patient** 166
   Chavi Sethi
9. **Cardiovascular Disease and Pregnancy** 186
   Chavi Sethi

SECTION 4: Pediatric System

10. **Anesthesia for Cleft Lip and Palate** 215
    Puja Choubey
11. **Approach to a Case of Congenital Diaphragmatic Hernia** 226
    Puja Choubey

12. **Anesthetic Considerations for Tracheoesophageal Fistula** **237**
Puja Choubey

13. **Pyloric Stenosis and Anesthesia** **248**
Puja Choubey

SECTION 5: Nerve Blocks and Pain Management

14. **Nerve Blocks of Upper Extremities** **263**
Bhawna Singh

15. **Nerve Blocks of Lower Extremities** **283**
Bhawna Singh

16. **Complex Regional Pain Syndromes** **307**
Bhawna Singh

17. **Perioperative Pain Management** **322**
Bhawna Singh

SECTION 6: Gastrointestinal System

18. **Approach to a Case of Laparoscopic Surgery** **343**
Amrita Gupta, Avanish Kumar Saxena

SECTION 7: Nervous System

19. **Traumatic Brain Injury** **373**
Ankita Jaiswal

20. **Space Occupying Lesion (SOL) and Craniotomy** **397**
Ankita Jaiswal

SECTION 8: Ophthalmic Anesthesia

21. **Open Globe Injury and Cataract** **421**
Chavi Sethi

SECTION 9: Anesthesia for Orthopedic Surgeries

22. **Approach to a Case for Orthopedic Surgery** **445**
Chavi Sethi, Amit Sehgal

SECTION 10: Anesthesia for Electroconvulsive Therapy

23. Anesthesia for Electroconvulsive Therapy 515
Chavi Sethi

SECTION 11: Miscellaneous

24. Burns and Anesthesia 537
Chavi Sethi

25. Myasthenia Gravis and Anesthesia 583
Chavi Sethi

26. Malignant Hyperthermia 601
Chitrangana Gupta

27. Morbid Obesity and Anesthesia 628
Amrita Gupta, Dharmendra Kumar Yadav

28. Postoperative Respiratory Failure 655
Shambhavi Chauhan

Index 665

CHAPTER 2

Diabetes Mellitus

Amrita Gupta

JAYPEE BROTHERS

CASE

A 55-year-old woman is a known case of cervical cancer which is posted for vaginal hysterectomy. She is obese [body mass index (BMI) = 32 kg/m^2] and is a known case of type 2 diabetes mellitus (DM), hypertension, and dearrange lipid profile for 12 years. She takes enalapril, metoprolol, atorvastatin, metformin, sitagliptin, and recently, insulin glargine, 20 units subcutaneous, daily for refractory hyperglycemia. She measures her serum glucose on and off at home. Values are generally 145–220 mg/dL. She experiences an early and a prolonged sense of fullness after meals and an unpleasant sour taste at night two or three times per week.

Laboratory values are notable for a serum creatinine of 2.2 mg/dL and a serum glucose of 220 mg/dL. She has not taken any medications today and had nothing to eat since midnight.

MEDICAL DISEASE AND DIFFERENTIAL DIAGNOSIS

Q1. What is the epidemiology of diabetes mellitus (DM) in the general population?

Ans. The epidemiology of diabetes mellitus (DM) in the general population is as follows:

- *Prevalence:* Approximately 9.4% of the global population has DM, with 463 million adults living with DM worldwide (2019 data).
- *Incidence:* The number of people with DM is expected to rise to 578 million by 2030 and 700 million by 2045.
- *Type 2 diabetes mellitus:* Accounts for 85–90% of all DM cases, with a higher prevalence in obese and physically inactive individuals.
- *Risk factors:* Age, family history, obesity, physical inactivity, ethnicity, and history of gestational diabetes or delivering a baby over 4 kg.
- *Complications:* DM increases the risk of cardiovascular disease, chronic kidney disease, nerve damage, and blindness.
- *Mortality:* DM is the ninth leading cause of death globally, accounting for 1.6 million deaths per year.

In the United States specifically:

- *Prevalence:* Over 34 million people have DM, with one in five being undiagnosed.
- *Incidence:* 1.5 million new cases are diagnosed each year.
- *Type 2 DM:* Accounts for 90–95% of all DM cases.

Q2. What are the factors in the etiology of the disease?

Ans. The etiology of type 2 diabetes mellitus (DM) is multifactorial, involving:

- *Genetics:* Family history, ethnicity, and genetic predisposition.
- *Obesity:* Central obesity, insulin resistance, and chronic inflammation.
- *Physical inactivity:* Sedentary lifestyle, reduced muscle mass, and decreased insulin sensitivity.

- *Diet:* Consuming high-calorie, high-fat, high-sugar, and high-salt foods.
- *Age:* Increased risk with advancing age, especially after 45 years.
- *Ethnicity:* Higher risk in African-Americans, Hispanics/Latinos, and American Indians.
- *History of gestational diabetes:* Increased risk of developing type 2 DM after gestational diabetes.
- *Polycystic ovary syndrome (PCOS):* Hormonal imbalance and insulin resistance.
- *Sleep apnea:* Chronic sleep deprivation and insulin resistance.
- *Stress:* Chronic stress and cortisol dysregulation.
- *Medications:* Certain medications, such as steroids and certain psychiatric medications.
- *Pancreatic β-cell dysfunction:* Impaired insulin secretion and function.
- *Insulin resistance:* Reduced insulin sensitivity in muscles, liver, and adipose tissue.
- *Inflammation:* Chronic low-grade inflammation and oxidative stress.
- *Environmental factors:* Exposure to toxins, air pollution, and other environmental stressors.

Q3. How is diabetes mellitus (DM) classified?

Ans. Diabetes mellitus is classified into several types based on etiology, clinical presentation, and pathophysiology:

- *Type 1 DM:* Autoimmune destruction of pancreatic β-cells, resulting in absolute insulin deficiency.
- *Type 2 DM:* Insulin resistance and impaired insulin secretion, often associated with obesity and physical inactivity.
- *Gestational DM:* Diabetes diagnosed during pregnancy, usually resolving after delivery.
- *Latent autoimmune diabetes in adults (LADA):* It is an autoimmune form of type 1 DM, developing in adults.
- *Maturity-onset diabetes of the young (MODY):* Genetic forms of DM, often presenting in young adulthood.
- *Secondary DM:* Developing as a consequence of another medical condition or treatment, such as:
  - Pancreatic diseases (e.g., pancreatitis and pancreatic surgery)
  - Endocrine disorders (e.g., Cushing syndrome and pheochromocytoma)
  - Medications (e.g., steroids and certain psychiatric medications)
  - Infections (e.g., congenital rubella)
- *Prediabetes:* Impaired fasting glucose or impaired glucose tolerance, increasing the risk of developing type 2 DM.
- *Other specific types:* Including DM caused by genetic defects, infections, or other rare conditions.

Q4. What are the complications of diabetes mellitus (DM)?

Ans. Diabetes mellitus can lead to various complications, including:

Microvascular Complications

- *Diabetic retinopathy:* Damage to the retina, potentially leading to blindness.
- *Diabetic nephropathy:* Kidney damage, potentially leading to chronic kidney disease or end-stage renal disease.
- *Diabetic neuropathy:* Nerve damage, causing pain, numbness, or tingling in hands and feet.

Macrovascular Complications

- *Cardiovascular disease:* Increased risk of heart attacks, strokes, and peripheral artery disease.

JAYPEE BROTHERS

- *Peripheral artery disease:* Narrowing or blockage of blood vessels in legs and feet.

Other Complications

- *Foot ulcers:* Open sores on the feet, potentially leading to infections and amputations.
- *Infections:* Increased risk of infections, particularly of the skin, urinary tract, and respiratory system.
- *Cognitive impairment:* Increased risk of dementia and cognitive decline.
- *Hearing loss:* Increased risk of hearing impairment.
- *Mental health:* Increased risk of depression, anxiety, and other mental health conditions.
- *Gastrointestinal issues:* Gastroparesis, diarrhea, and constipation.
- *Sexual dysfunction:* Erectile dysfunction and decreased libido.
- *Bone and joint issues:* Osteoporosis, osteopenia, and Charcot joint.
- *Skin conditions:* Acne, psoriasis, and other skin conditions.
- *Hypoglycemia:* Low blood sugar episodes, potentially life-threatening if untreated.

Q5. How are the different forms of this illness treated?

Ans. Treatment for DM varies depending on the type and severity of the disease. Here is an overview of the different forms of DM and their treatments:

Type 1 DM

- *Insulin therapy:* Lifelong insulin replacement via injections or pumps.
- *Blood glucose monitoring:* Regular monitoring to adjust insulin doses.
- *Lifestyle modifications:* Healthy diet, regular exercise, and weight management.

Type 2 DM

- *Lifestyle modifications:* Healthy diet, regular exercise, and weight loss.
- *Oral medications:* Metformin, sulfonylureas, dipeptidyl peptidase-4 (DPP-4) inhibitors, and others to improve insulin sensitivity and secretion.
- *Insulin therapy:* Added if oral medications are insufficient or if the patient has a high glycated hemoglobin (HbA1c) level.
- *Bariatric surgery:* Considered for obese patients with type 2 DM.

Gestational DM

- *Lifestyle modifications:* Healthy diet, regular exercise, and weight management.
- *Blood glucose monitoring:* Regular monitoring to adjust treatment.
- *Insulin therapy:* If lifestyle modifications are insufficient or if the patient has a high HbA1c level.

Latent Autoimmune Diabetes in Adults and Maturity-onset Diabetes of the Young

- *Insulin therapy:* Similar to type 1 DM.
- *Oral medications:* May be used in addition to insulin therapy.

Secondary DM

- *Treatment of underlying condition:* Managing the underlying condition or discontinuing medications that contribute to DM.
- *Insulin therapy or oral medications:* If necessary, to manage blood sugar levels.

Prediabetes

- *Lifestyle modifications:* Healthy diet, regular exercise, and weight loss.
- *Metformin:* May be prescribed to prevent progression to type 2 DM.

Q6. How is control of the disease adequately monitored?

Ans. Control of DM is adequately monitored through:

- *Glycemic monitoring:* Regular self-monitoring of blood glucose levels using a glucometer.

JAYPEE BROTHERS

- *Hemoglobin A1c testing:* Measures average blood glucose levels over the past 2–3 months.
- *Fasting plasma glucose (FPG) testing:* Measures blood glucose levels after an overnight fast.
- *Oral glucose tolerance test (OGTT):* Measures blood glucose levels after consuming a 75 gm of glucose in 250–300 mL of water.
- *Urine tests:* Checks for ketones, protein, or other abnormalities.
- *Blood pressure monitoring:* Regular checks to ensure blood pressure is within target range.
- *Lipid profile:* Regular checks to ensure cholesterol and triglyceride levels are within target range.
- *Kidney function tests:* Regular checks to ensure kidney function is normal.
- *Foot and eye examinations:* Regular checks to detect any complications.
- *Continuous glucose monitoring (CGM):* Wearable devices that track glucose levels throughout the day.

By regularly monitoring these parameters, healthcare providers can:

- Assess the effectiveness of treatment plans.
- Identify potential complications early.
- Make adjustments to treatment plans as needed.
- Provide personalized guidance and support.

Q7. What are some of the factors that alter insulin requirements?

Ans. Several factors can alter insulin requirements in individuals with DM:

- *Diet:* Changes in food intake, timing, and composition can affect insulin needs.
- *Physical activity:* Increased exercise can decrease insulin requirements, while decreased activity can increase them.
- *Weight changes:* Weight gain or loss can impact insulin sensitivity and requirements.
- *Hormonal changes:* Hormonal fluctuations during menstruation, pregnancy, or menopause can affect insulin needs.
- *Stress:* Physical or emotional stress can increase insulin requirements.
- *Sleep patterns:* Poor sleep quality or duration can impact insulin sensitivity.
- *Medications:* Certain medications, such as steroids, can increase insulin requirements.
- *Illness or infection:* Acute illnesses can increase insulin requirements.
- *Travel or time zone changes:* Changes in routine and time zones can affect insulin needs.
- *Aging:* Insulin requirements may decrease with age due to decreased muscle mass and insulin sensitivity.
- *Kidney function:* Decreased kidney function can affect insulin clearance and requirements.
- *Other medical conditions:* Certain conditions, such as liver disease or pancreatic disorders, can impact insulin requirements.

Q8. What are the principles of management of diabetic ketoacidosis (DKA)?

Ans. The principles of management of diabetic ketoacidosis (DKA) include:

- *Prompt recognition and diagnosis:* Identify DKA symptoms, such as hyperglycemia, ketosis, and acidosis.
- *Fluid replacement:* Aggressive fluid resuscitation with isotonic saline to correct dehydration and electrolyte imbalances.
- *Insulin therapy:* Administer insulin to reduce hyperglycemia and ketoacid production.

JAYPEE BROTHERS

- *Electrolyte management:* Monitor and correct electrolyte imbalances, particularly potassium and sodium.
- *Glucose monitoring:* Frequent glucose checks to adjust insulin doses.
- *Ketone monitoring:* Monitor ketone levels to assess treatment effectiveness.
- *Acidosis correction:* Correct acidosis with insulin and fluids.
- *Potassium replacement:* Replace potassium losses to prevent hypokalemia.
- *Phosphate replacement:* Replace phosphate losses to prevent hypophosphatemia.
- *Close monitoring:* Closely monitor vital signs, glucose, and electrolyte levels.
- *Address underlying causes:* Identify and address underlying causes of DKA, such as infection or medication nonadherence.
- *Transition to subcutaneous insulin:* Once DKA is resolved, transition to subcutaneous insulin regimen.

Q9. What is a hyperglycemic hyperosmolar state?

Ans. A hyperglycemic hyperosmolar state (HHS) is a serious complication of diabetes mellitus, characterized by:

- *Severe hyperglycemia:* Blood glucose levels typically above 600 mg/dL (33 mmol/L).
- *Hyperosmolarity:* Elevated serum osmolality, usually above 320 mOsm/kg.
- *Dehydration:* Significant fluid loss and dehydration.
- *Electrolyte imbalance:* Abnormalities in sodium, potassium, and other electrolyte levels.
- *No or minimal ketosis:* Unlike diabetic ketoacidosis (DKA), HHS typically has little to no ketosis.

Hyperglycemic hyperosmolar state often develops in individuals with type 2 DM, particularly those with:

- Poor medication adherence
- Infection or illness
- Renal impairment
- Older age

Symptoms of HHS include:

- Severe thirst and dehydration
- Dark urine
- Fatigue
- Confusion
- Seizures (in severe cases)

Treatment of HHS involves:

- Aggressive fluid replacement
- Insulin therapy
- Electrolyte correction
- Close monitoring

Management of Diabetic Ketoacidosis and Hyperglycemia Hyperosmolar State

Difference between diabetic ketoacidosis and hyperglycemia hyperosmolar state has been outlined in **Table 1**.

Fluid Management

Fluid replacement varies based on age, weight, hemodynamics, and comorbidities.

A reasonable approach follows:

- *Replace intravascular volume:* Give 1 L 0.9% NaCl over 30–60 minutes. Give an additional 1–2 L q30–60 minutes until

TABLE 1: Difference between diabetic ketoacidosis and hyperglycemia hyperosmolar state.

Plasma glucose (mg/dL)	>250	>600
pH	<7.3	>7.3
HCO_3 (mEq/L)	<15	>15
Urine ketone	+++	Small/-
Serum ketone	+++	>320 mOsm/kg
Anion gap	>15	<15
Mental status	Alert, drowsy, stupor/coma	Stupor/coma
Water deficit (mL/kg)	100	100–200
Sodium deficit (mEq/kg)	7–10	5–13

JAYPEE BROTHERS

hemodynamically stable and urine output increased.
- *Replace total body water deficit:* Change to 0.45% NaCl and infuse at 150–500 mL/hour.

When blood glucose (BG) <250 mg/dL, add dextrose 5% and decrease to 100–200 mL/hour.
- Fluid is replaced over 12–24 hours and patients are generally depleted 3–6 L in DKA and 8–12 L in HHS.
- Monitor urine output, heart rate, blood pressure, and respiratory status. Care must be taken in patients with congestive heart failure and kidney disease.

Insulin Treatment
- Bolus 0.1–0.15 U/kg regular insulin intravenously (IV) [subcutaneous (SC)/intramuscular (IM) can be given if no IV access].
- Start continuous IV insulin infusion via an infusion pump.

Standard infusion is 100 U *regular human insulin* (iv t 1/2, 5–9 minutes) in 100 mL 0.9% NaCl.

For *DKA*, start at 0.1 U/kg/hour.

For *HHS,* start at 0.05 U/kg/hour; delay insulin in *HHS* until at least 1 L normal saline (NS) infused.

Blood Glucose Monitoring
- Check initial BG q1h. *Goal decrease in BG is 50–75 mg/dL/hour.*
- Once stable (three consecutive values decreased in target range), change BG monitoring to q2h. Resume q1h BG monitoring for each change in the insulin infusion rate (see below).
- Add dextrose 5% to IV fluids when BG <250 mg/dL.

For *DKA goal BG 150–200 mg/dL until anion gap closed.*

For *HHS goal BG is 250–300 mg/dL until mental status improves.*

Changing the Insulin Infusion Rate
- ↓ IV insulin by 50%/hour, if BG decreases by >100 mg/dL/hour in any 1-hour period.
- ↑ insulin drip by 50%/hour if change in BG is <50 mg/dL/hour.
- For *DKA and HSS,* when BG decreases to 250 mg/dL, insulin infusion may need to be decreased 50% to maintain glucose at target levels.

Start SC insulin when:
- Anion gap closed (DKA)
- Serum bicarbonate increases to >15 mEq/L (DKA)
- Patient is able to eat.
- Mental status improves (HHS)

Stop the insulin drip after all of the following are done.
- Give short-acting insulin (aspart or lispro) SC at twice the hourly IV rate (e.g., if IV rate is 5 U/hour, give 10 U short-acting insulin SC).
- Give long-acting insulin [neutral protamine Hagedorn (NPH) or glargine] SC at 0.2–0.3 U/kg (divided q8 for NPH), or home-insulin dose.
- Ensure the patient has a meal and is eating.

Potassium (K^+):
- *K^+ >5.5 mEq/L:* Leave potassium supplement out of IVF.
- *K^+ 4–5.4 mEq/L:* Add 20 mEq KCl/L to IVF.
- *K^+ 3–3.9 mEq/L:* Add 40 mEq KCl/L to IVF.
- *K^+ <3 mEq/L:* Add 60 mEq KCl/L to IVF.

In DKA, if initial K^+ is <3.3 mEq/L, *do not* give IV insulin until the serum K^+ is supplemented to >3.3 mmol/L due to the risk of severe hypokalemia.

Sodium (Na^+):
- Hypoglycemia causes an artifactually low serum sodium, and the correct value must be calculated. Corrected Na^+ = Measured

JAYPEE BROTHERS

Na^+ (mmol/L) + [1.6 {measured BG (mg/dL) – 100}/100]

- Nat replaced with IV fluids initially as 0.9% NaCl for first 1–3 L and then as 0.45% NaCl (see "Fluid Management").

Bicarbonate (HCO_3):

- Usually in DKA only.
- Replacement generally not necessary as insulin will reverse the HCO_3 deficit with its inhibition of lipolysis.
- Consider HCO_3 in the following situations:
  - Severe acidosis with pH <7 (the HCO_3 should be stopped once the pH is >7.1)
  - Severe loss of buffering capacity when serum HCO_3^- <5–10 mEq/L
  - Acidosis-induced cardiac or respiratory distress
  - Severe hyperkalemia

Q10. Enumerate different type of insulin?

Ans.

Insulin type	*Onset*	*Peak*	*Duration*
Long-acting: • Detemir (Levemir) • Glargine (Lantus)	 • 3–4 hours • 90 minutes	 • 6–8 hours • None	 • 6–23 hours • 24 hours
Intermediate-acting: NPH (Humulin N)	 1–2 hours	 4–10 hours	 14 or more hours
Short-acting: • Aspart (Novolog) • Glulisine (Apidra) • Lispro (Humalog) • Regular	 • 15 minutes • 15–30 minutes • 15 minutes • 30–60 minutes	 • 1–3 hours • 30–60 minutes • 30–90 minutes • 2–4 hours	 • 3–5 hours • 4 hours • 3–5 hours • 5–8 hours
Mixed:* • NPH/lispro or aspart • NPH/regular	 • 15–30 minutes • 30–60 minutes	 • Dual • Dual	 • 14–24 hours • 14–24 hours

**NPH/regular:* Humulin 70/30, Novolin 70/30, Humulin 50/50; NPH/lispro or aspart: Humalog 75/25, Novolog 70/30, Humalog 50/50

Q11. What is Basal insulin, nutritional insulin and correctional insulin?

Ans.

- *Basal insulin:* This controls hyperglycemia during periods when a patient is not eating (such as at night, between meals, or during fasting) and can be administered as long-acting insulin (such as glargine or detemir) once or twice daily.
- *Nutritional insulin:* This is also referred to as meal-time or prandial insulin, and it assists in managing hyperglycemia associated with carbohydrate intake from meals, enteral, or parenteral nutrition. This can be achieved with either rapid-acting insulin (such as lispro, aspart, or glulisine) or short-acting insulin (regular).
- *Correctional insulin:* This is used to counteract hyperglycemia that exceeds the targeted levels and utilizes either rapid-acting or short-acting insulin. The formulations are combined into a single dose when correctional insulin is administered alongside nutritional insulin.

JAYPEE BROTHERS

Q12. What is sliding scale?

Ans.

RBS (mmol)	Insulin dose (IU) S/C route
6–8	02
8–10	04
10–12	06
12–14	08
14–16	10
16–18	12
18–20	14
20–22	16

PREOPERATIVE EVALUATION AND PREPARATION

Q13. How should this patient be evaluated?

Ans. This patient should be evaluated with a comprehensive preoperative assessment, including:

- *Medical history:* Review of diabetes, hypertension, dyslipidemia, and other medical conditions.
- *Physical examination:* Focus on cardiovascular and respiratory systems.
- *Laboratory tests:*
  - Complete blood count (CBC)
  - Basic metabolic panel (BMP)
  - Liver function tests (LFTs)
  - Coagulation studies [prothrombin time (PT)/international normalized ratio (INR), and partial thromboplastin time (PTT)]
  - Glycated hemoglobin (HbA1c) (to assess diabetes control)
  - Electrocardiogram (ECG)
- *Cardiovascular evaluation:*
  - Echocardiogram (if indicated)
  - Stress test (if indicated)
- *Respiratory evaluation:*
  - Pulmonary function tests (PFTs) (if indicated)
- *Diabetes management:*
  - Assessment of current diabetes treatment
  - Evaluation of glucose control
  - Development of a perioperative diabetes management plan
- *Medication review:*
  - Review of current medications
  - Identification of medications that may need to be adjusted or discontinued **(Table 2)** perioperatively.
- *Surgical risk assessment:*
  - Evaluation of surgical risk factors [e.g., the American Society of Anesthesiologists (ASA) classification]
- *Anesthesia consultation:*
  - Discussion of anesthesia options and risks
- *Preoperative optimization:*
  - Optimization of diabetes control
  - Optimization of cardiovascular and respiratory function

Q14. How would the stiff joint syndrome affect her airway management?

Ans. The stiff joint syndrome, also known as diabetic cheiroarthropathy, can affect airway management in several ways **(Figs. 1 and 2)**.

- *Limited neck mobility:* Stiffness in the neck joints can make it difficult to achieve optimal neck extension, which can make intubation more challenging.
- *Reduced mouth opening:* Stiffness in the temporomandibular joint (TMJ) can limit mouth opening, making it harder to insert laryngoscopic blades or other airway devices.
- *Difficulty with laryngoscopy:* The stiffness can make it more difficult to visualize the glottis during laryngoscopy.
- *Increased risk of airway obstruction:* The stiffness can lead to a more rigid airway, increasing the risk of obstruction during anesthesia.

JAYPEE BROTHERS

TABLE 2: Oral and injectable antihyperglycemic agents—preoperative management.

Class	*Drug*	*Physiological effect*	*Risk of hypoglycemia*	*Day before surgery*	*Day of surgery*
Biguanides	Metformin	Decrease hepatic glucose production	Low	Continue regular use	Omit dose if eGFR <60 mL/min/1.73 m^2 or if IV contrast anticipated, if not, take morning dose
Sulfonylureas	Gliclazide, glipizide, and glimepiride	Increase insulin secretion	Moderate to high	Continue regular use	Omit dose
Thiazolidinediones	Rosiglitazone and pioglitazone	Increase insulin sensitivity	Low	Continue regular use	Omit dose
Glinides	Nateglinide and repaglinide	Increase insulin secretion	Moderate	Continue regular use	Omit dose
A-glucosidase inhibitors	Acarbose	Slow intestinal carbohydrate absorption	Low	Continue regular use	Omit dose
Dipeptidyl peptidase-4 inhibitors	Sitagliptin and saxagliptin	Glucose-dependent increase in insulin section and decrease in glucagon secretion	Low	Continue regular use	Continue regular use
Glucagon-like peptide-1 analogs	Exenatide liraglutide	Glucose-dependent increase in insulin secretion	Low	Continue regular use	Omit dose
Sodium glucose CO transporter-2 inhibitors	Dapagliflozin and canagliflozin	Decreases glucose reabsorption by the kidney	Low	Omit dose	Omit dose
Long-acting basal insulin	Levemir and lantus		Low	Take 75% of dose	Take 50% of dose
Mixed insulin combination of long- and short-acting, i.e., 70/30 or 75/25			Moderate to high	Take 75% of dose	If morning blood glucose is: • >200 mg/dL, take 50% of dose • <200 mg/dL, omit dose

(eGFR: estimated glomerular filtration rate)

JAYPEE BROTHERS

- *Potential for difficult mask ventilation:* Stiffness in the face and neck can make mask ventilation more challenging.

Tests

- *Prayer sign:* Palms and fingers oppose each others.

  Diabetic patients have stiff joints and they are unable to do prayer test, i.e., test is positive **(Fig. 1)**.



Fig. 1: Tests to assess joint stiffness. *Prayer sign test:* Ability to oppose the palms and fingers as in prayer. Diabetic patients with stiff joints have a positive test as they are unable to do this.

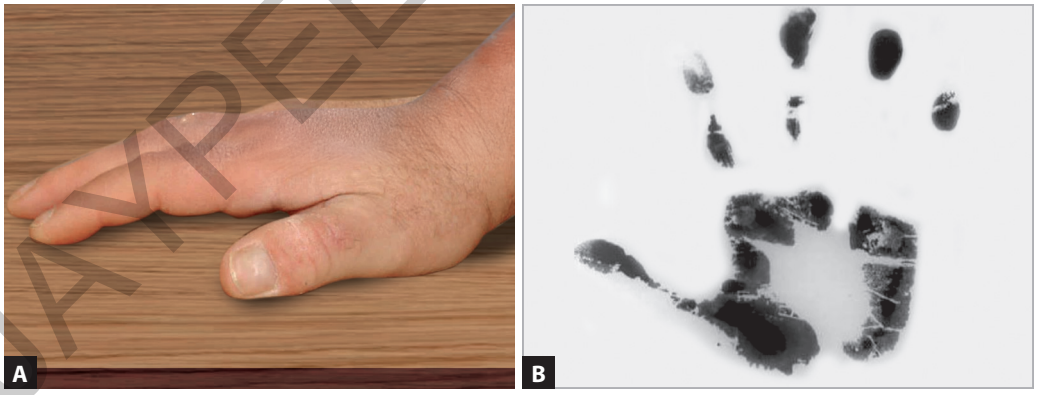
- *Palm print test:* Alteration in palm print due to stiffness of interphalangeal joints **(Figs. 2A and B)**.

To address these challenges, the anesthesiologist may consider:

- *Fiberoptic intubation:* A more flexible approach to intubation.
- *Video laryngoscopy:* Can help to improve visualization of the glottis.
- *Alternative airway devices:* Such as a laryngeal mask airway (LMA) or a supraglottic airway device.
- *Careful patient's positioning:* To optimize neck extension and mouth opening.
- *Preparation for potential difficult airway:* Having a plan in place for a difficult airway, including available equipment and personnel.

Q15. What are the signs and implications of autonomic neuropathy in the autonomic diabetic patient?

Ans. Autonomic neuropathy in diabetic patients can manifest with various signs and symptoms, including:



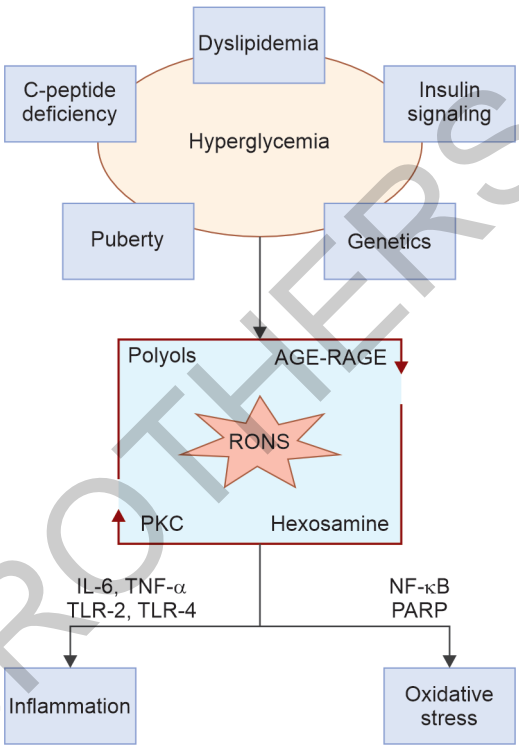
Figs. 2A and B: *Palm print test:* Stiffness of the 4th and 5th interphalangeal joints causes alteration in palm print. The palm and fingers of the dominant hand of the patient is painted with ink. Then, the hand is firmly pressed on a white sheet of paper on a hard surface.
Grade 0: All phalangeal areas visible.
Grade 1: Deficiency in interphalangeal areas of 4th and/or 5th digit.
Grade 2: Deficiency in interphalangeal areas of 2nd to 5th digit.
Grade 3: Only the tips of digits seen.

JAYPEE BROTHERS

- *Orthostatic hypotension:* Dizziness, lightheadedness, or fainting upon standing.
- *Gastroparesis:* Nausea, vomiting, bloating, and abdominal pain due to delayed gastric emptying.
- *Diarrhea or constipation:* Altered bowel habits due to impaired gut motility.
- *Urinary retention or incontinence:* Impaired bladder function leading to retention or involuntary urination.
- *Erectile dysfunction:* Impotence or ejaculatory dysfunction in men.
- *Sudomotor dysfunction:* Altered sweating patterns, leading to dry skin or excessive sweating.
- *Cardiovascular autonomic neuropathy:* Impaired heart rate variability, leading to silent myocardial ischemia or increased risk of cardiac arrhythmias.
- *Pupillary dysfunction:* Abnormal pupil responses to light.
- *Impaired glucose counterregulation:* Reduced ability to respond to hypoglycemia.

Pathogenesis of diabetic autonomic neuropathy (DAN) demonstrated in **Flowchart 1**.

Flowchart 1: Pathogenesis of diabetic autonomic neuropathy (DAN).



(IL-6: interleukin-6; NF-κB: nuclear factor-kappa B; PARP: poly-adenosine-diphosphate-ribose polymerase; PKC: protein kinase C; TLR: toll-like receptor; TNF: tumor necrosis factor)

Pathogenesis of Diabetic Autonomic Neuropathy

Implications of autonomic neuropathy in diabetic patients include:

- Increased risk of silent myocardial infarction
- Increased risk of cardiac arrhythmias
- Gastrointestinal complications
- Urinary tract infections
- Erectile dysfunction
- Impaired quality of life
- Increased risk of falls and injuries
- Worsening of other diabetic complications

Q16. What are the tests for diabetic autonomic neuropathy?

Ans.

- *Beat-to-beat heart rate variability:* With the patient at rest and supine, heart rate is monitored by ECG while the patient breathes in and out at 6 breaths/min, paced by a metronome or similar device. A difference in heart rate of >15 bpm is normal and <10 bpm is abnormal. The lowest normal value for the expiration-inspiration ratio of the R-R interval is 1.17 in patient aged 20–24; this value decreases with age.
- *Heart rate response to standing:* During continuous ECG monitoring, the R-R interval is measured at beats 15 and

JAYPEE BROTHERS

30 after standing. Typically, a tachycardia is followed by reflex bradycardia. The 30:15 ratio should be >1.03.

- *Heart rate response to Valsalva maneuver:* The subject forcibly exhales into the mouthpiece of a manometer to 40 mm Hg for 15 s during ECG monitoring. Healthy subjects develop tachycardia and peripheral vasoconstriction during strain and an overshoot bradycardia and rise in blood pressure with release. The normal ratio of longest to shortest R-R is >1.2.
- *Systolic blood pressure response to standing:* Systolic blood pressure is measured in the supine subject. The patient stands, and the systolic blood pressure is measured after 2 minutes. Normal response is a fall of <10 mm Hg; borderline is a fall of 10–29 mm Hg; abnormal is a fall of >30 mm Hg with symptoms.
- *Diastolic blood pressure response to isometric exercise:* The subject squeezes a handgrip dynamometer to establish a maximum. Grip is then squeezed at 30% maximum for 5 minutes. A normal response for diastolic blood pressure is a rise of >16 mm Hg in the opposite arm.

Q17. How should this patient be prepared for anesthesia and surgery?

Ans. To prepare this patient for anesthesia and surgery:

- *Optimize diabetes control:* Aim for a HbA1c level <7% and stable blood glucose levels.
- *Cardiovascular evaluation:* Assess cardiovascular risk factors and perform necessary tests (e.g., stress test and echocardiogram).
- *Autonomic neuropathy assessment:* Evaluate the signs and symptoms of autonomic neuropathy and consider cardiac autonomic function tests.
- *Medication management:*
  - Continue current diabetes medications, but adjust doses as needed (*see* **Table 2**).
  - Stop or adjust medications that may interact with anesthesia [e.g., angiotensin-converting enzyme (ace) inhibitors, β-blockers].
- *Fluid and electrolyte management:* Ensure adequate hydration and electrolyte balance.
- *Surgical site preparation:* Prepare the surgical site to reduce infection risk.
- *Anesthesia plan:* Develop a personalized anesthesia plan considering the patient's medical history, autonomic neuropathy, and surgical procedure.
- *Intraoperative monitoring:* Monitor vital signs, blood glucose, and electrolyte levels closely during surgery.
- *Postoperative care:* Plan for close monitoring and management of blood glucose, pain, and potential complications in the postoperative period.

Multidisciplinary team involvement: Involve a team of healthcare professionals, including anesthesiologists, surgeons, endocrinologists, and nurses, to ensure comprehensive care.

INTRAOPERATIVE MANAGEMENT

Q18. What are the effects of anesthesia and surgery on insulin and glucose metabolism?

Ans. Anesthesia and surgery can significantly impact insulin and glucose metabolism, leading to:

- *Increased glucose release:* Stress response to surgery causes glucose release from energy stores.
- *Insulin resistance:* Stress hormones (e.g., cortisol and adrenaline) reduce insulin sensitivity.

JAYPEE BROTHERS

for detailed information on anesthesia books, visit our website **www.jaypeebrothers.com,** for detailed information on anesthesia books, visit ou

Handbook of Clinical Anesthesia: A Case-based Approach is a comprehensive resource tailored for anesthesia practitioners across all levels of experience, from students to seasoned professionals. This book stands out for its practical approach, presenting a series of real-world scenarios that reflect the complexities of everyday clinical practice. Each case is carefully crafted to bridge the gap between theoretical knowledge and practical application, providing a nuanced understanding of anesthesia in a variety of clinical contexts.

Target Audience and Market

This book is designed for a diverse audience, including anesthesia residents, practicing anesthesiologists, and nurse anesthetists. It also serves as a valuable resource for healthcare professionals involved in perioperative care, offering practical insights and strategies to enhance clinical practice. Medical students and candidates preparing for superspecialty examinations will find it particularly beneficial as a reference guide.

Contributors

The book is authored by distinguished professionals in the field. Dr Chavi Sethi, Associate Professor at Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh, India and Dr Amrita Gupta, Associate Professor at Sarojini Naidu Medical College, Agra, Uttar Pradesh, India, lead the authorship. Additional contributions come from Dr Puja Choubey, Assistant Professor at MLB Medical College, Jhansi; Dr Chitrangana Gupta, Assistant Professor at MLB Medical College, Jhansi; Dr Bhawna Singh, Assistant Professor at Rohilkhand Medical College, Bareilly, Uttar Pradesh, India; Dr Shambhavi Chauhan, Critical Care Consultant at Teerthankar Mahaveer University, Moradabad, Uttar Pradesh; Dr Amit Sehgal, Professor at MLB Medical College, Jhansi.; Dr Ankita Jaiswal, Assistant Professor at SN Medical College, Jhansi; Dr Avanish Kumar Saxena, Professor and Head, Department of Surgery, FH Medical College, Etmadpur, Agra, Uttar Pradesh; and Dharmendra Kumar Yadav, Associate Professor in the Department of Anesthesiology, Moti Lal Nehru Medical College, Prayagraj, Uttar Pradesh, India.

Key Features

- The book offers a rich array of features designed to support clinical learning and practice. It covers a diverse range of scenarios, including pediatric, obstetric, cardiovascular, neurological, and trauma anesthesia, ensuring a comprehensive understanding of various surgical procedures and their anesthetic considerations. Each case is examined from preoperative assessment through intraoperative management to postoperative care, providing a complete view of patient's management.
- Management strategies are grounded in the latest evidence-based practices, ensuring the highest standards of patient care. The book also includes expert insights, practical tips, and clinical pearls from leading anesthesiologists. Interactive learning is encouraged through questions and discussion points at the end of each topic, making it an excellent tool for self-assessment and group discussions. Additionally, it emphasizes a multidisciplinary approach, highlighting the crucial roles of various healthcare professionals in perioperative care.
- By addressing real-world challenges and providing practical, evidence-based solutions, *Handbook of Clinical Anesthesia: A Case-based Approach* equips practitioners with the knowledge and skills needed to enhance patient outcomes and advance their clinical practice.



Chavi Sethi MD (Anesthesia) FIPM is an Associate Professor in the Department of Anesthesiology, Critical Care and Pain Management, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh, India where she has been a dedicated Educator and Practitioner since 2009. She earned her MD in Anesthesia from the same institution and has continued to advance her expertise, particularly through a Fellowship in Pain Management, reflecting her strong interest in pain medicine. She is passionate about developing new ideas and skills in the field of "Anesthesia," and she has contributed significantly to academic discourse, having published numerous articles in national and international journals. Her commitment to both learning and teaching continues to inspire her students and peers alike.



Amrita Gupta MD (Anesthesia) FIPM is an Associate Professor in the Department of Anesthesiology, Critical Care and Pain Management, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India. She holds an MBBS from RNT Medical College, Udaipur, and an MD from SN Medical College. Furthering her expertise, she completed a fellowship in pain management from Bhopal, where she specialized in this vital field. Her career has been marked by a strong dedication to patients' care and the education of future medical professionals. As an educator, she is passionate about mentoring students and advancing medical knowledge. In her clinical work, she strives to deliver compassionate care, always aiming to integrate the latest medical advancements into her practice. Her commitment to anesthesia and pain management continues to shape her contributions to both academic and clinical fields.

Printed in India

Available at all medical bookstores or buy online at www.ejaypee.com

JAYPEE BROTHERS
Medical Publishers (P) Ltd.
EMCA House, 23/23-B, Ansari Road,
Daryaganj, New Delhi - 110 002, INDIA
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers
Follow us on instagram.com/JaypeeMedicalPublishers

Shelving Recommendation
ANESTHESIA

ISBN 978-93-6616-387-1