Oncology Surgical Pharmacy Practice:

Pharmaceutical Care for Perioperative Cancer Patients

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Professional Title

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Academic Appointments

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- Committee Member, Anti-Tumor Drug Committee, Chinese Pharmaceutical Association
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Surgery: A Complex System Beyond Simple Operations

•Blood-brain barrier
•Preferred medications

Brain metastasis→

Lung cancer internal treatment?

←Coronary heart disease

? Cardiology department

• Cardiac function
• Anticoagulation, lipid-lowering, blood pressure stabilization

•EGFR(-)
•Chemotherapy

Lung mass→

Lung cancer surgery treatment?

←Diabetic Nephropathy

? Endocrinology department

• Kidney function
• Blood glucose, blood pressure , kidney protection

Malnutrition→

Nutrition department?

←Jaundice, liver metastasis

? Hepatology department

• Assess Nutritional status
• Enteral and parenteral nutrition

•Liver function
•hepatoprotective medications

Medical Holism

Characteristics of Oncological Surgery Work

Characteristics of Oncological Surgery Work

Disease Characteristics

- ✓ Tumor location
- ✓ Tumor staging
- ✓ Tumor typing
- ✓ Tumor burden
- ✓ Tumor emergencies
- ✓ Infection risks

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Patient Characteristics

- ◆ Elderly patients
- ◆ Comorbidities
- ◆ Multiple hospital admissions
- ◆ Hepatic and renal damage
- ◆ Pleural and abdominal effusions
- ◆ Physical condition

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Clinical Characteristics

- ➢ Types of surgery
- ➢ Management of comorbidities
- ➢ Thromboembolism
- ➢ Infection management
- ➢ Intestinal obstruction
- ➢ Combined therapy

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Medication Characteristics

- ● Selection of medication
- ● Combination therapy
- ● Administration methods
- ● Dosage adjustment
- ● Drug interactions
- ● Adverse reactions

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Perioperative Full-Process Safety Management for Oncological Surgery Patients

Preoperative Medication History

- Past medication history
- Impact of radiotherapy and chemotherapy drugs (e.g., myelosuppression, liver and kidney function damage, thrombosis, bleeding, etc.)

Perioperative Monitoring

- Generally consistent with surgery: infection, pain, PONV (postoperative nausea and vomiting), ERAS (enhanced recovery after surgery), nutrition, anticoagulation, etc., closely monitor medication use;
- Special attention points for oncology patients: drug effects.

Postoperative Recovery

Discharge Medication Education

- If continuing chemotherapy, medication education is necessary, as well as proper home protection;
- Focus on nutritional support during home treatment;
- Keep a medication log if necessary, to record adverse reactions after medication and follow up.

Next Step Treatment Follow-up

- Medication education is required if chemotherapy continues

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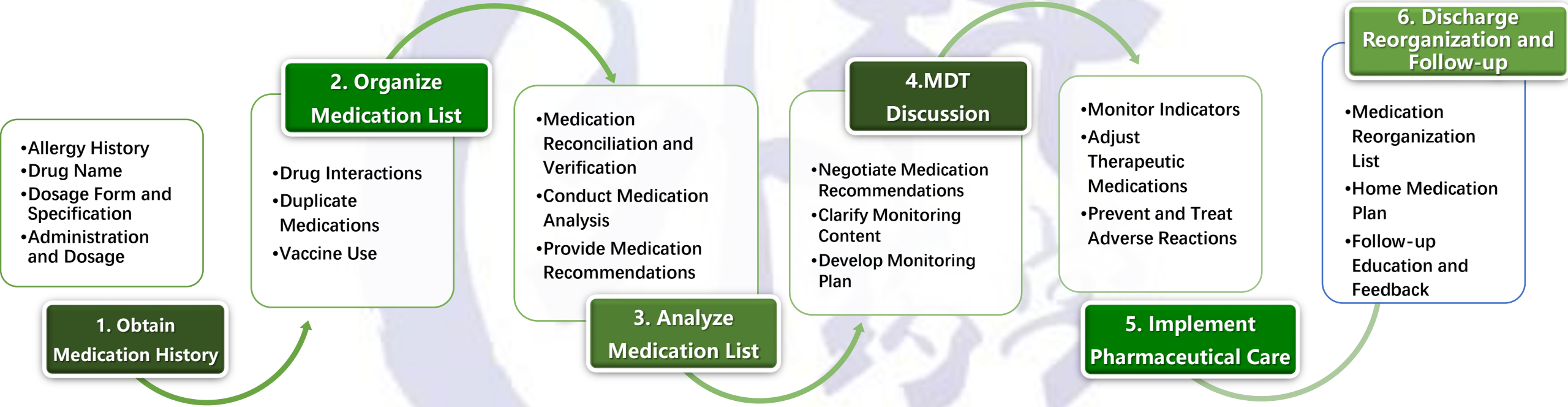
Perioperative Monitoring Pathway for Oncology Patient: STEP 1~6



Medications used for long-term anti-cancer treatment

Medications used only during the perioperative period

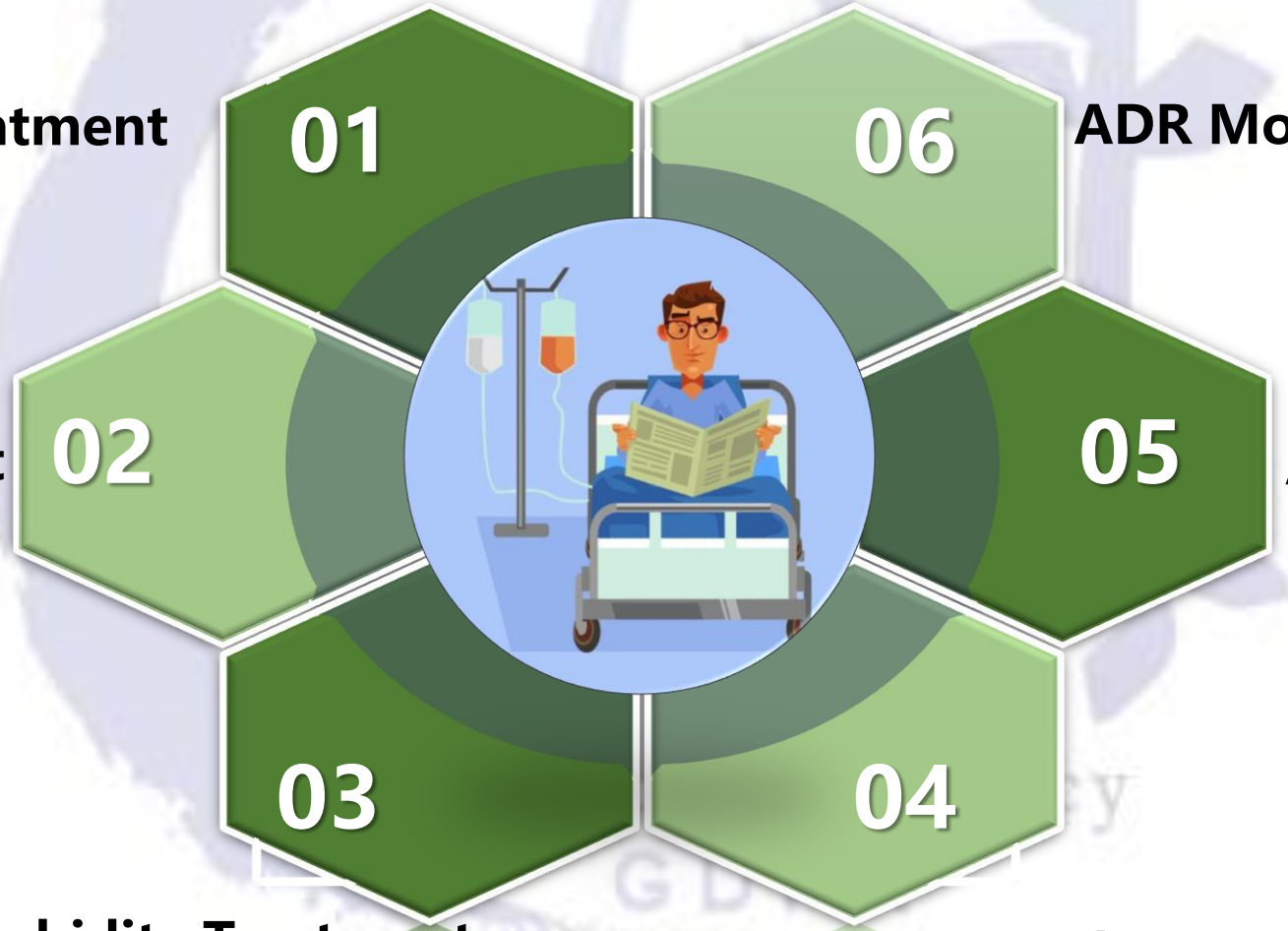
Medications used long-term for chronic diseases

Dietary supplements, traditional Chinese medicine, food

Medication-Related Problems (MRPs)	
No Need for Medication	No clear medical indication; Multiple medications used when only one is is necessarry; Non-pharmacological treatment is more suitable for the disease; Using medication to intervene another medication-related adverse events that could have been avoided.
Need to Add Medication	Medication is requisite; Preventive medication is needed to reduce the risk of new diseases; Additional medication is needed to achieve synergistic or additive effects.
Current Medication is Ineffective	There is tolerance or resistance to the medication; The medication form is unsuitable; The medication is ineffective for the current disease.
Medication Dose is Too Low	The dose is too low to produce the desired therapeutic effect; The dosing interval is too long to produce the desired therapeutic effect; Drug interactions have reduced the effective dose of the medication; The duration of medication is too short to produce the desired effect.
Medication-Related Adverse Events	Adverse reactions caused by the medication that are unrelated to the dose; Safer medication is needed due to the presence of various risk factors; Drug interactions have led to adverse reactions unrelated to the dose; Frequent changes in the medication regimen; Medication-induced allergic reactions; The medication is contraindicated due to the presence of risk factors; The medication form is unsuitable.
Medication Dose is Too High	The medication dose is too high; The dosing interval is too short; the duration of medication administration is too long; Drug interactions have led to toxic reactions; The single dose administration time is too rapid.
Poor Medication Adherence of Patient	The patient does not understand the instructions; The patient is unwilling to take medication for treatment; the patient forgets to take medication; the medication is too expensive for the patient; The patient cannot swallow or self-administer medication; The patient cannot obtain the medication.

SYSUCC: Pharmaceutical Care Pattern for Perioperative Oncology Patients

Medication Therapy | **Safety Management**



01 Cancer Treatment

02 Supportive Treatment

03 Comorbidity Treatment

04 Patient Education

05 ADR Management

06 ADR Monitoring

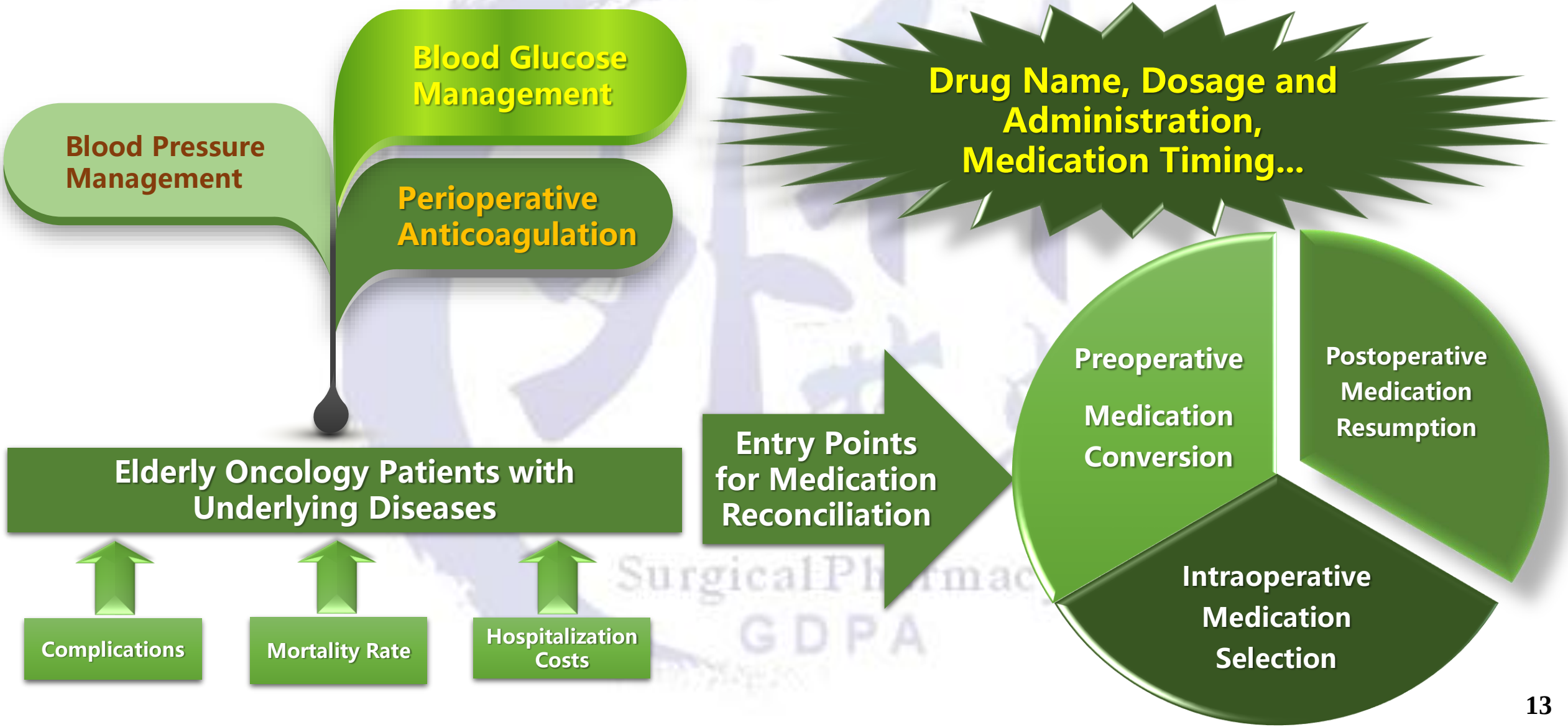
Cancer Treatment: Perioperative Medication Reconciliation

Drug Category	Drug	Molecular Target	Preoperative	Postoperative
HER-2 Targeted Therapy	Trastuzumab	HER-2	Assess patient's cardiac function (risk of heart failure), monitor left ventricular ejection fraction (LVEF) before surgery. Pay attention to the use of angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and beta-blockers.	Monitor risk of heart failure, LVEF monitoring.
HER-2 Targeted Therapy	Pertuzumab	HER-2	Assess patient's cardiac function, monitor left ventricular ejection fraction (LVEF) before surgery.	Monitor LVEF.
HER-2 Targeted Therapy	Lapatinib	HER-2	Assess patient's cardiopulmonary function (interstitial pneumonia can occur in very few patients), monitor left ventricular ejection fraction (LVEF) before surgery.	Monitor LVEF.
mTOR Inhibitor	Everolimus	mTOR、VEGF	Monitor renal function, blood sugar, blood lipids, discontinue this medication at least 1 week before elective surgery. (FDA) Everolimus is an mTOR inhibitor, mTOR pathway inhibition can cause dysfunction of pancreatic islet cells, impaired insulin secretion, and affect glucose metabolism, leading to hyperglycemia.	Do not administer for at least 2 weeks after major surgery, until the wound is fully healed. (FDA)
Anti-angiogenic Drug	Bevacizumab	VEGFR、c-Kit、FLT-3	Monitor blood pressure, cardiac function, coagulation function. Discontinue medication 4-6 weeks before elective surgery.	Monitor (gastrointestinal) bleeding risk, wound healing complications.

Oncology Treatment: Perioperative Medication Reconciliation

Drug Category	Drug	Molecular Target	Preoperative	Postoperative
Multi-target Tyrosine Kinase Inhibitor	Furetinib	VEGFR-1、VEGFR-2、VEGFR-3	Monitor blood pressure, coagulation function. Closely monitor bleeding risk, and monitor routine blood tests, coagulation indicators.	Monitor postoperative bleeding risk, wound healing complications.
Multi-target Tyrosine Kinase Inhibitor	Regorafenib	KIT、RET、PDGFR、VEGFR1	Monitor blood pressure, coagulation function. This drug can cause severe, even fatal, hepatotoxicity, and liver function should be monitored before surgery.	Do not administer for at least 2 weeks after major surgery, until the wound is fully healed. (FDA)
Multi-target	Sorafenib	VEGFR、PDGFR、FLT-3	Monitor blood pressure, cardiac function, thyroid function; it is recommended to suspend this drug for patients undergoing major surgery.	The timing of using this drug after surgery should be clinically considered to ensure wound healing.
Multi-target	Lenvatinib	VEGFR、FGFR、PDGFR、KIT、RET	Monitor blood pressure, cardiac function, thyroid function; discontinue this drug at least 1 week before elective surgery. (FDA)	Do not administer for at least 2 weeks after major surgery, until the wound is fully healed. (FDA)
Multi-target	Sunitinib	VEGFR、PDG-FR、FLT-3	Monitor cardiac function, adrenal function, liver function, thyroid function before surgery; suspend the use of this drug for patients undergoing major surgical procedures.	Determine whether to resume this drug after surgery based on recovery.

Comorbid Treatment: Blood Sugar/Blood Pressure/Anticoagulation



Comorbid Treatment: Pathways and Methods for Blood Pressure Management

Drug Category	Mechanism and Impact of Anticancer and Related Therapeutic Drugs on Blood Pressure During the Perioperative Period	Effect on Blood Pressure
Corticosteroids	Cause sodium and water retention, disorders of sugar, protein and fat metabolism; Enhance the pressor effect of the RAAS system; Increase the sensitivity of vascular smooth muscle to vasoconstrictive substances.	**Increase**
Thyroid Hormones	Stimulate the sympathetic nervous system to increase blood pressure.	**Increase**
Anti-angiogenic Agents (Bevacizumab, Sunitinib, Sorafenib, etc.)	Inhibit VEGF, leading to reduced production of NO and prostacyclin, vasoconstriction; decreased microvascular density, thereby increasing peripheral circulatory resistance and blood pressure; anti-angiogenic drugs have certain effects on the neuroendocrine system, possibly affecting blood pressure by influencing certain hormones.	**Increase**
Recombinant Human Erythropoietin	Promotes the release of endothelin-1, increases the synthesis of thromboxane B2, decreases the synthesis of prostaglandin I2 and nitric oxide from thrombomodulin, and causes abnormal reactivity and vasoconstriction of peripheral vessels, leading to increased peripheral vascular resistance.	**Increase**
Antidepressants	Tricyclic antidepressants inhibit the reuptake of norepinephrine and serotonin, increasing their concentrations in the synaptic cleft, producing a sympathomimetic effect; monoamine oxidase inhibitors inhibit the activity of monoamine oxidase, causing the accumulation of catecholamines and serotonin, leading to increased blood pressure.	**Increase**
Anticancer Drugs (Cyclophosphamide, Busulfan, etc.), Sulfonamides, Cephalosporins, Aminoglycosides, Amphotericin B	Direct renal damage leading to acute renal failure, increased renin levels, leading to secondary renal hypertension	**Increase**
Macrolide Antibiotics (Clarithromycin, Erythromycin (except Azithromycin))	Inhibit cytochrome P450 isozyme 3A4, reducing the metabolism of substrates of cytochrome P450 3A4 (calcium channel blockers)	**Decrease**
Imidazole Antifungals	Imidazole drugs are inhibitors of P450 3A4, reducing the metabolism of substrates of cytochrome P450 3A4 (calcium channel blockers)	**Decrease**

Supportive Treatment: Pain Management

Use of Opioids in Patients with Renal Impairment

(Assessed by Glomerular Filtration Rate GFR)

GFR	＞50ml/min	10-50ml/min	＜10ml/min
Morphine	Original dose	Reduce to 50-70%	Reduce to 25-50%
Oxycodone	Original dose	Reduce to 50%	Contraindicated
Hydromorphone	Original dose	Reduce to 25-50%	Use with caution
Fentanyl	Original dose	Reduce to 50-100%	Reduce to 50%
Tramadol	Original dose	Appropriately extend dosing intervals, monitor renal function closely	
Dezocine	Original dose	Use with reduced dosage	
Buprenorphine	Original dose	Initial dosing interval should be extended to 6-8 hours, subsequent doses adjusted based on patient response	
Nalbuphine	Original dose	No adjustment needed	
Codeine	Original dose	Contraindicated	

Use of Opioids in Patients with Liver Impairment

Drug	Mild Liver Impairment	Moderate Liver Impairment	Severe Liver Impairment
Morphine	Original dose	Dosing interval extended by 2 times	Use with caution
Oxycodone	Original dose	Reduce to 50-70%	Use with caution
Nalbuphine	Original dose	Adjust dose	Use with caution
Hydromorphone	Original dose	Reduce to 25-50%	Use with caution
Fentanyl	No adjustment needed		
Tramadol	Appropriately extend dosing intervals, monitor liver function closely		
Dezocine	Use with reduced dosage		
Buprenorphine	Initial dosing interval should be extended to 6-8 hours, subsequent doses adjusted based on patient response		
Codeine	Contraindicated		

《Clinical Pharmacist Postoperative Pain Management Guidelines》 issued by GuangDong Pharmaceutical Association on January 31, 2019.

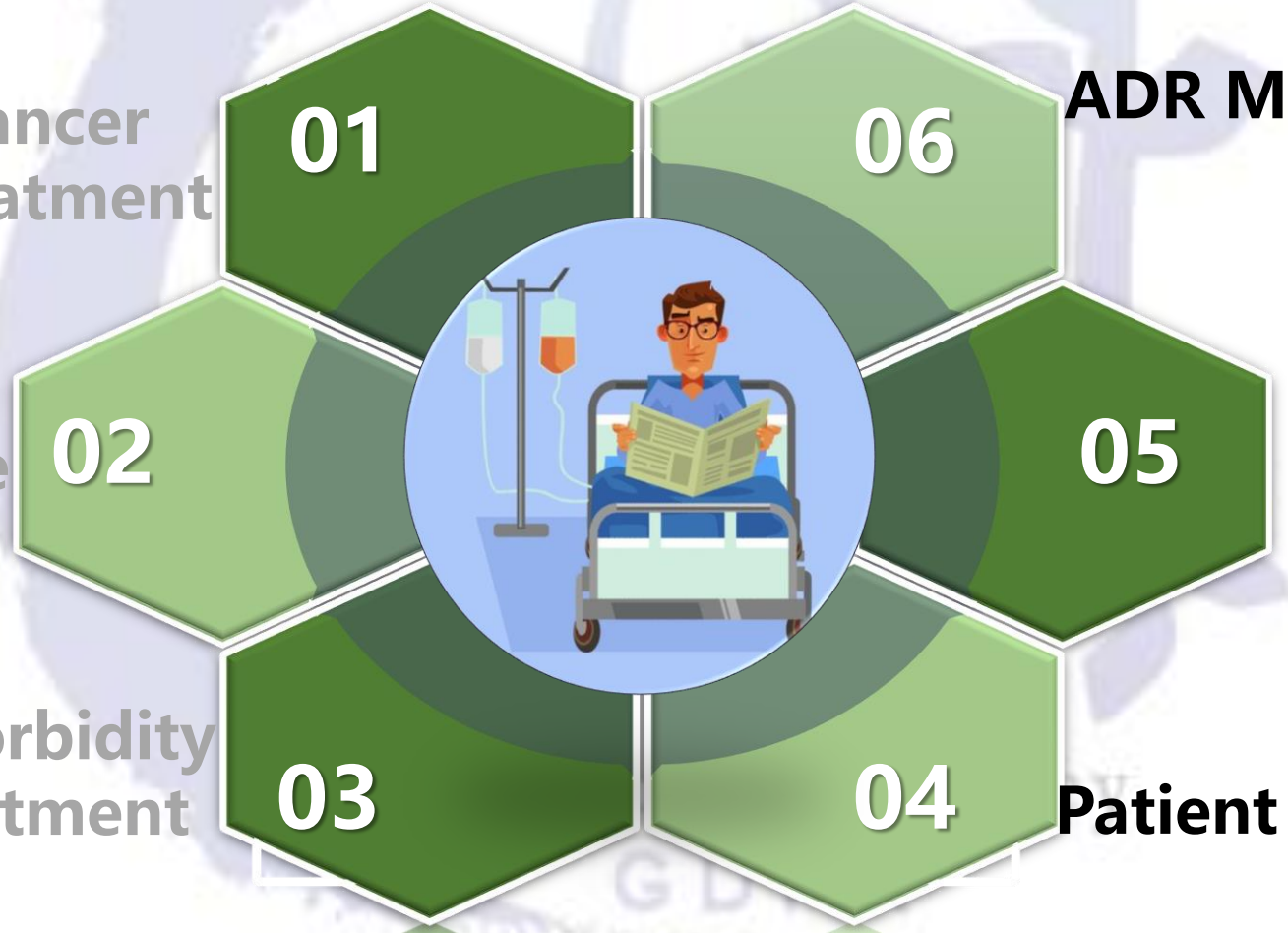
Supportive Care:
Dosage and timing of medication for preventing PONV.

Drugs	Administration Time	Adult Dosage	Child Dosage
Ondansetron	Preoperatively	4mg IV	0.05～0.1mg/kg IV（maximum dose 4mg）
Granisetron	Preoperatively	0.35～3mg IV	0.04mg/kg IV（maximum dose 0.6mg）
Tropisetron	Preoperatively	2mg IV	0.1mg/kg IV（maximum dose 2mg）
Palonosetron	before induction	0.075mg IV	/
Aprepitant	before induction	40mg PO	/
Dexamethasone	after induction	4～5mg IV	0.15mg/kg IV （maximum dose 5mg）
Droperidol	preoperatively	0.625～1.25mg IV	0.01～0.015mg/kg IV（maximum dose 1.25mg）
Flupenthixol	preoperatively or post-induction	0.5～2mg IM or IV	/
Diphenhydramine	induction	1mg/kg IV	0.5mg/kg IV（maximum dose 25mg）
Scopolamine	the night before surgery or 2-4 hours before the start of surgery	patch	/

SYSUCC:
Pharmaceutical Care for Perioperative Oncology Patients

Pharmacotherapy

Safety Management



Mechanisms of Adverse Reactions to Antineoplastic Drugs

Different mechanisms of action, different adverse reactions

Chemotherapy
Target: Rapidly Dividing Cells
Adverse Reactions: The non-specificity of the treatment results in a variety of adverse reactions, involving multiple organs and tissues.

Immunotherapy
Mechanism: Relief of Immune Suppression
Adverse Reactions: Immune system activation results in distinct AEs, known as Immune-Related Adverse Events (irAEs).

Targeted Therapy
Target: Driver Genes
Adverse Reactions: The expression of targets in both tumor and normal tissues reflects the characteristics of targeted therapy.

Different treatment modalities have different toxicity profiles.

Some irAEs may resemble those of other treatment modalities, but the etiology differs.

Managing irAEs varies from traditional chemotherapy and targeted therapy.

Perioperative Risk Management of Anti-Angiogenic Drugs

- Surgery for tumors requires combined neoadjuvant or adjuvant chemotherapy. However, new anti-tumor drugs, especially anti-angiogenic ones, increase bleeding risk and postoperative complications, impacting treatment success.

- **Wound healing complications** （**WHC**）include wound dehiscence, delayed wound healing, ecchymosis, wound bleeding, infection, and gastrointestinal perforation.

- According to the latest "Guidelines for Clinical Application of New Anti-tumor Drugs" issued by the National Health Commission (2021 edition), drugs associated with the aforementioned adverse reactions include bevacizumab, anlotinib, regorafenib, lenvatinib, apatinib, sunitinib, futibatinib, and ibrutinib.

Perioperative Antiangiogenic Drug Risk Management: Bevacizumab

- **Bevacizumab is a VEGF monoclonal antibody. Other drugs are TKIs, which can inhibit tumor angiogenesis and disrupt platelet-endothelial interactions, hindering wound healing. Careful timing between medication use and surgery is crucial to minimize bleeding risk and postoperative complications.**

- **Perioperative Interval: Bevacizumab, widely used, has clinical data showing a close relationship between its administration interval and surgery to postoperative complications.**

- **Most physicians recommend avoiding bevacizumab for 4 weeks before and after major surgery, or within 2 weeks of minor procedures (e.g., catheter placement and biopsies)[1]. The optimal washout time for bevacizumab varies with different tumor types.**

[1]Christina E Bailey et al. *Cancer Treat Rev.* 2018, 68:38-46.

Perioperative Risk Management of Antiangiogenic Therapy: Bevacizumab

Tumor Type	Preoperative Medication Discontinuation and Timing of Postoperative DrugResumption
Colorectal liver metastases (CRLM)	Bose D. recommends a medication interval of 6-8 weeks for patients with colorectal cancer liver metastasis. For postoperative adjuvant therapy of colorectal cancer, initiation of systemic therapy with bevacizumab is probably safe after 28 days. However, in patients with comorbid conditions or with wound-healing issues (minor wound infections), starting bevacizumab therapy after several cycles of chemotherapy to extend the interval between surgery and bevacizumab therapy to 6-8 weeks[2].
	Christina E. Bailey agree with these suggestions and typically discontinue BV for 6 to 8 weeks before surgery for mCRC and wait 28 days after surgery prior to initiating adjuvant BV, assuming there are no wound healing issues[1].
Breast Cancer (BC)	The effects of neoadjuvant bevacizumab on breast surgery are unclear; Bose D. suggests discontinuation at least 4 weeks before surgery.
Central nervous system tumors (CNS)	Due to the heightened risk of wound dehiscence in CNS tumor patients, exacerbated by prior radiotherapy and ongoing corticosteroid use, a delay of 2-4 weeks for bevacizumab treatment post-stereotactic biopsy and 4-6 weeks after craniotomy is recommended.
Renal cell carcinoma (RCC)	Clinical trials demonstrate that a 4-week interval between bevacizumab treatment and surgery does not delay wound healing.
Lung cancer (LC)	For low-risk pulmonary resections, such as wedge resection or simple lobectomy, a 4-week interval for bevacizumab treatment is advised. For more complex surgeries, like chest wall or bronchoplastic resections, a 6-8 week interval is recommended.

[1] Christina E Bailey et al. *Cancer Treat Rev*. 2018, 68:38-46. [2] Debashish Bose et al. *Lancet Oncol.* 2010, 11:373-82

Perioperative Bleeding Risk Management with Other Small Molecule Targeted Drugs

◆ In summary, the tyrosine kinase inhibitors currently used in clinical practice have relatively short half-lives, which usually allow for surgery to be performed earlier. However, it is still recommended to undergo a washout period.

◆More specifically, in cases of renal cell carcinoma, data shows that for sorafenib, discontinuation about 3 days before surgery is advised [3], while for sunitinib, a 1-week withdrawal is recommended [4]; another group of RCC cases indicated that there should be at least a 2-week washout period between TKI and surgery [5].

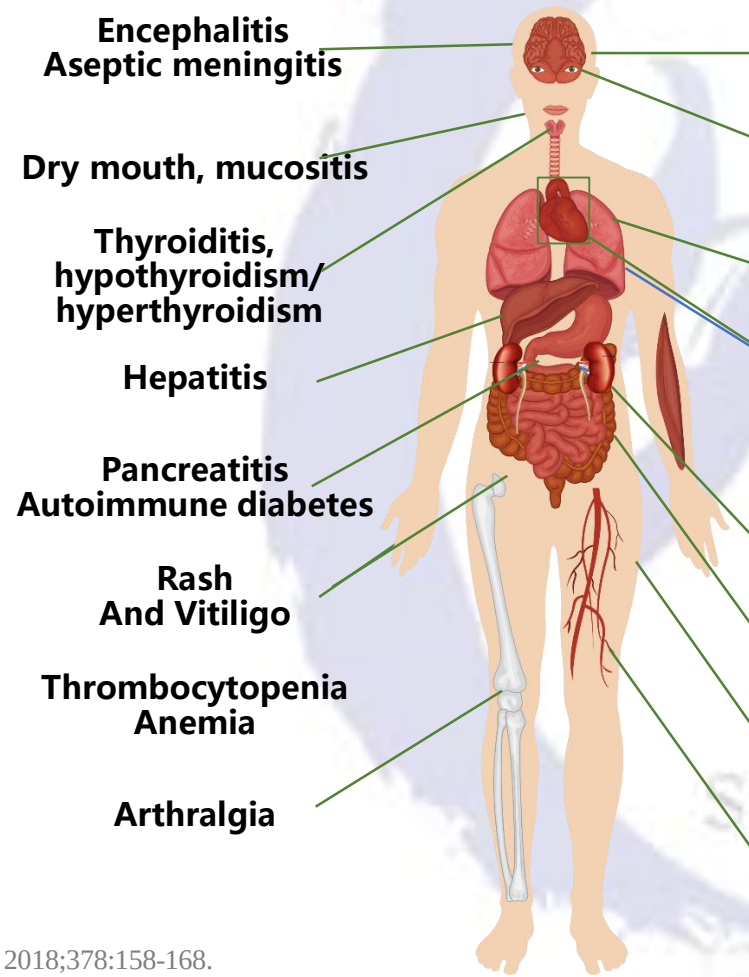
◆Ibrutinib is a small molecule inhibitor of BTK (Bruton's tyrosine kinase) with an average half-life of 4-6 hours. Ibrutinib is primarily metabolized and eliminated by the liver, and data from one study showed increased exposure to ibrutinib in patients with liver damage. Age and gender do not have a clinically significant impact on the pharmacokinetics of ibrutinib. Research suggests that based on the type of surgery and bleeding risk, ibrutinib should be temporarily discontinued for at least 3-7 days before and after surgery.

◆The "Guidelines for the Clinical Application of Novel Anti-tumor Drugs" (2021 edition) recommend that due to the anti-angiogenic properties of these drugs, which may inhibit or impair wound healing, it is advisable to suspend the use of anti-angiogenic drugs in patients undergoing major surgery as a precaution. Especially after major surgery, treatment can only be resumed once clinical judgment confirms adequate wound healing.

[3] Pooleri GK et al. *Indian J Surg Oncol.* 2012, 3:114-9.
[4] Thomas AA et al. *J Urol.* 2009, 182:881-6.
[5] Harshman LC et al. *Urol Oncol.* 2013, 31:379-85.

Immune-related adverse events (irAEs)

◆ Immune checkpoint blockade may cause inflammatory side effects by boosting immune activity.



The majority of immune-related adverse events (irAEs) are mild to moderate in severity.

Severity range: Asymptomatic - life-threatening.

Common: Dermatologic, GI (gastrointestinal), endocrine, pulmonary.

Rare: CV, renal, ocular, neurologic, hematologic.

Episodes are unpredictable and can occur after discontinuation of treatment.

The majority of immune-related adverse events (irAEs) show reversible recovery after corticosteroid treatment.

N Engl J Med. 2018;378:158-168.
J Immunother Cancer. 2017;5:95.
Eur J Cancer. 2016;54:139-148.

Adverse reaction monitoring parameters.

- **According to the "Toxicity Management Guidelines for Immune Checkpoint Inhibitors,"**
- **monitoring parameters include:**
- (1) Complete blood count and routine biochemistry: During ICIs treatment, recheck every 2-3 weeks, then every 6-12 weeks orAccording to re-examination indications:
- (2) Radiological examination: Repeat chest, abdomen, and pelvic CT scans every 4-6 weeks during ICIs treatment;
- (3) Skin and mucosa: Conduct examinations during each ward round for patients with immune-related dermatological histories; record lesion type and severity;
- (4) Thyroid: Recheck TFTs, including TSH, T3, and T4, every 4-6 weeks during ICIs treatment, then every 12 weeks based on symptoms;
- (5) Adrenal/pituitary: Recheck morning plasma cortisol, ACTH, and TFTs every 2-3 weeks during ICIs treatment, followed by 6-12 week follow-ups;
- (6) Lung: Recheck resting or active blood oxygen saturation and routine pulmonary radiological exams every 4-6 weeks during ICIs treatment;
- (7) Cardiovascular: Recheck ECG and cardiac enzyme profiles every 2-4 weeks during ICIs treatment.

Chinese Society of Clinical Oncology (CSCO) Toxicity Guidelines for Immune Checkpoint Inhibitors (2021).

Pharmacovigilance

- Target population: patients, family members/caregivers.
- Helps with early identification, reporting, and treatment of related ADRs.
- Patients are well-informed, reducing unnecessary "panic".

Patient education.	**1. Before treatment, inform the doctor about any history of autoimmune diseases, organ-specific diseases, endocrine disorders, and infectious diseases; smoking status, family history, pregnancy status, previous anticancer treatments, and baseline medication use; and prior bowel habits (frequency and consistency).**
	2. If symptoms and signs of pneumonia occur during treatment, such as difficulty breathing, oxygen desaturation, cough, chest pain, or any discomfort, immediately inform the medical staff.
	3. If symptoms and signs related to colitis occur during treatment, such as abdominal pain, diarrhea, mucous or bloody stools, immediately inform the medical staff.
	4. Post-treatment, immune-related hepatitis may occur; patients should regularly visit the hospital to monitor changes in liver function and associated symptoms and signs of hepatitis. If immune-related hepatitis develops, the frequency of liver function tests should be increased.
	5. The medication may cause fatigue or other discomforts; it is advised not to drive or operate machinery during the treatment period.
	6. Return to the hospital for a follow-up examination of complete blood count and biochemical tests two weeks after discharge, and have the doctor assess whether to continue treatment.

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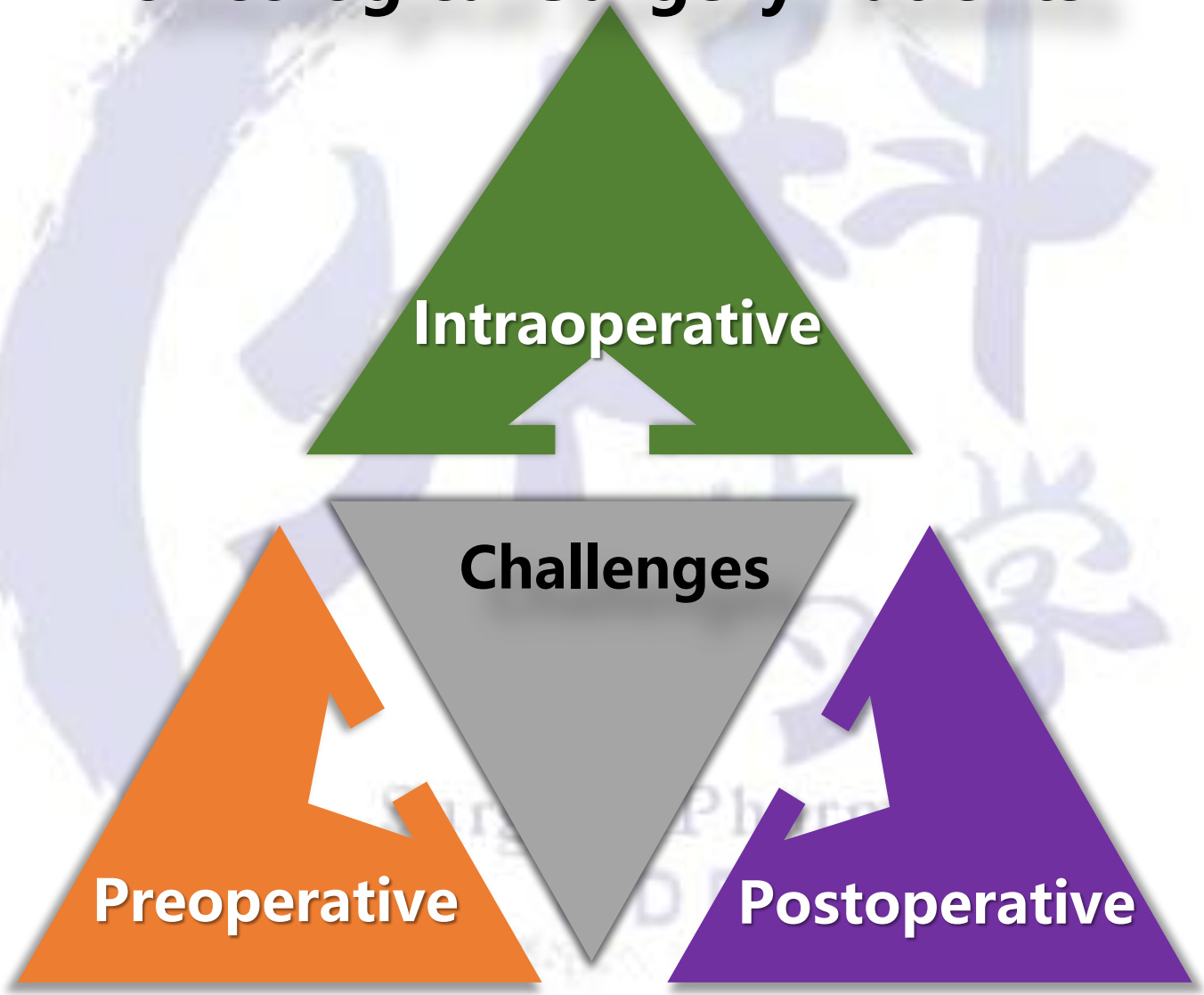

Perioperative Safety Management for Oncological Surgery Patients

◆ CASE1 Preoperative Medication History: Bone Marrow Suppression Related to Radiochemotherapy

◆Patient Female, 34 years old, admitted on July 28, 2020. Admission diagnosis: Rectal adenocarcinoma cT4aN2M0 Stage IIIc undergoing neoadjuvant radiochemotherapy.

◆From May 8 to June 10, 2020, radiotherapy was administered: PGTV 50Gy/25 fractions, PTV 45Gy/25 fractions.

◆Received XELOX regimen on April 23, May 22, June 12, and July 10, 2020, with Grade III leukopenia and Grade II thrombocytopenia in cycle 3; Grade II leukopenia, Grade III neutropenia, and Grade II thrombocytopenia in cycle 4.

date	WBC 10E9/L	NE 10E9/L	PLT 10E9/L
7.22	2.27	0.69	106
7.27	26.3	21.5	75 –I°
8.2	25.1	23.27	64-II°
8.5	14.4	12.88	126

◆From July 28 to August 5, thrombopoietin 15,000 units H qd.

■After admission, Grade II thrombocytopenia persisted, affecting surgery. Administered thrombopoietin 15,000U H qd promptly.

Perioperative Safety Management for Oncological Surgery Patients

CASE2 Perioperative Medication Monitoring: MDT Discussion for Treatment Plan Selection

Treatment Options for Resectable Synchronous Liver Metastases in Colon Cancer

1. Synchronous or staged colectomy with liver (preferred) and/or local therapy;
2. Or neoadjuvant therapy (for 2–3 mo) FOLFOX (preferred) or CAPEOX (preferred) or FOLFIRI (category 2B) followed by synchronous or staged colectomy and resection of metastases;
3. Or Colectomy, followed by chemotherapy (for 2–3 mo) FOLFOX(preferred) or CAPEOX (preferred) or FOLFIRI (category 2B) and staged resection.

Adjuvant Therapy (Metastatic lesions have been resected)

1. FOLFOX（preferred）
2. Or CAPOX（preferred）
3. Or capecitabine or 5-FU/CF

- A total of 6 months of perioperative treatment is preferred.

Perioperative Safety Management for Oncological Surgery Patients

◆ CASE2 Perioperative Medication Management - Liver Function Impairment

Chemotherapy Drugs	Liver Injury	Manifestations	Mechanism	Impact on Surgery
5-Fluorouracil (5-FU)	Steatosis	Accumulation of fat in hepatocytes (a form of non-alcoholic fatty liver disease (NAFLD))	◆5-FU may disrupt the mitochondrial membrane, thereby disrupting fatty acid oxidation and leading to an increase in reactive oxygen species (ROS), causing fat to accumulate within the hepatocytes. ◆One of the metabolites of 5-FU, fluoro-β-alanine (FBAL), is suspected of impairing the liver's ability to metabolize drugs and substances, including fatty acids.	✓ Increased infection rate ✓ Elevated bilirubin levels ✓ Comorbidities such as obesity and diabetes in patients with steatosis may independently increase the incidence of complications.
Irinotecan	Steatohepatitis	Fatty infiltration, inflammation, and possible fibrosis of the liver	◆ Mainly involves mitochondrial dysfunction, similar to the steatosis caused by fluorouracil.	✓ Postoperative liver failure leading to increased postoperative morbidity and mortality
Oxaliplatin	Sinusoidal Obstruction Syndrome (SOS)	◻ Histological manifestations • Sinusoidal dilation/hepatocyte atrophy/peri-sinusoidal fibrosis/nodular regeneration ◻ Clinical manifestations • Hepatomegaly/jaundice/ascites/etc./Blue liver syndrome	◆ Disassembly of F-actin in liver sinusoidal endothelial cells (SEC).	✓ Increased risk of intraoperative bleeding ✓ Perioperative transfusion ✓ Biliary complications, sinusoidal injury accompanied by higher bilirubin levels ✓ prolonged hospital stay

◆ Colorectal Liver Metastasis Patients: The incidence of SOS can be as high as 79%; the risk of SOS is increased by 2.2 times when undergoing chemotherapy based on oxaliplatin.

G. Duwe et al. EJSO, 2017, 1-14

Perioperative Safety Management for Oncological Surgery Patients

CASE3 Postoperative Medication Management: Adverse Reactions Related to Oncology Drugs

➢Patient: Female, 34 years old, Rectal adenocarcinoma, ypT3N0M0, MDT treatment plan

Neoadjuvant Chemoradiotherapy from May 8 to June 10

PGTV 50Gy/25fractions

PTV45Gy/25fractions

Four cycles of XELOX regimen

Admitted on July 28

Admission Diagnosis: Rectal adenocarcinoma cT4aN2M0, Stage IIIc

Neoadjuvant chemoradiotherapy has been completed

Surgery on July 31

Laparoscopic Dixon procedure with ileostomy, postoperative pathology revealed rectal adenocarcinoma ypT3N0M0

Continue to complete postoperative chemotherapy with the XELOX regimen

Perioperative Safety Management for Oncological Surgery Patients

Postoperative Medication Management: Patient Education on Drug-Related Adverse Reactions

Item	Type	Prevention and Management
Hematological Toxicity	Bone marrow suppression	• Blood routine and biochemical routine examination weekly
Non-hematological Toxicity	Gastrointestinal Reactions	• Nausea and vomiting: Eat smaller and frequently, select healthy and nutritious foods, control portion sizes, avoid foods that are excessively hot or cold, etc. Contact the attending physician immediately for severe vomiting (lasting more than 24 hours). • Diarrhea: Avoid foods high in fiber, greasy, and spicy. To prevent dehydration, drink plenty of fluids. During oral medication, loose stools (diarrhea) are common and should be managed promptly with anti-diarrheal drugs such as loperamide. • Contact the attending physician immediately for severe diarrhea (more than 4 times a day), frequent loose stools, or nocturnal diarrhea, with or without abdominal pain.
	Hand-Foot Syndrome	• Wear loose shoes, avoid rubbing hands and feet repeatedly, moisturize, avoid warm water baths, etc.
	Skin and Mucosal Reactions	• Hyperpigmentation: Sun protection. • Oral Mucositis: Maintain thorough oral hygiene, to alleviate symptoms, rinse with warm water or saline, use a soft toothbrush, avoid irritating foods.
	Neurological Toxicity	• Avoid cold stimuli.
	Cardiovascular System	• Monitor cardiac condition during medication use.
	Other, such as allergic reactions	• Dyspnea, hypotension, bronchospasm

Contents

Oncology Surgical Pharmacy

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Comprehensive Pharmaceutical Management for Oncological Surgical Patients Led by Pharmacists

Pre-admission

- Collection of medication history
- Patients with comorbidities or using high concern medications
- Pharmaceutical assessment
- Preoperative medications reconciliation/simplification
- Suggestions for discontinuation, substitution, bridging, or continuation of originally prescribed medications;
- Providing personalized pharmaceutical recommendations for ERAS protocol treatment plans;
- Generating intervention recommendations and feedback to the surgical team.

Preoperative

- Patients admitted for surgery after outpatient assessment
- Key points of preoperative pharmaceutical services:
  - ✓ Perioperative medication education ;
  - ✓ Reviewing medical orders in conjunction with outpatient pharmaceutical pre-assessment records to ensure correct execution of medication reconciliation;
  - ✓ For high-risk situations identified during preoperative assessment, suggesting personalized medication intervention plans to the surgical team before surgery to optimize the ERAS protocol treatment plan.

Intraoperative

- Key points of intraoperative pharmaceutical care:
  - ✓ The suitability of the indications, types, and timing of antimicrobial drugs used in surgery, as well as any additional situations.
  - ✓ Monitoring intraoperative drug interactions, compatibility and adverse reactions, especially analgesic medications, analgesic pump application, prevention of nausea and vomiting, and airway management medications.
  - ✓ Reviewing anesthesia, nursing, and surgical records during surgery to identify factors related to adverse drug events and auditing medical orders planned for post-ERAS surgery.

Postoperative

- Key points of postoperative pharmaceutical care:
  - ✓ Postoperative re-evaluation: postoperative pain, postoperative nausea and vomiting, postoperative nutrition, and thrombosis prevention, etc;
  - ✓ Evaluating the efficacy, safety, and compliance of medications used in ERAS;
  - ✓ Postoperative medical order review and order reconciliation;
  - ✓ Focusing on drug-drug interactions;
  - ✓ Special attention to the care of special populations;
  - ✓ Special attention to the care of special populations.

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THANKS!