

Supplementary Materials: Clinical Pathways for Oncological Gastrectomy: Are They a Suitable Instrument for Process Standardization to Improve Process and Outcome Quality for Patients Undergoing Gastrectomy? A Retrospective Cohort Study

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Table S1. Clinical Pathway for oncological gastrectomy used in the CP group of the study.

| Name: | Surname: | Date of Surgery: | Date of Discharge: | | | | |
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| Gastrectomy | PRE-ADMISSION | INPATIENT TREATMENT admission | Day of surgery | 1st-3rd postoperative day | 4rd-7th. postoperative day | DAY OF DISCHARGE 7th postoperative day | POST-DISCHARGE |
| DIAGNOSTIC/MONITORING | <ul style="list-style-type: none"> <input type="checkbox"/> medical history <input type="checkbox"/> clinical examination <input type="checkbox"/> laboratory (blood count, electrolytes, liver- and kidney-specific values, coagulation, HbA1c for all patients, CEA, CA 19-9, CA 72-4) <input type="checkbox"/> esophagogastroduodenoscopy with endosonography and sampling (histology, HER-2-status, helicobacter eradication if necessary) <input type="checkbox"/> CT-neck-chest-abdomen <input type="checkbox"/> MRI liver in case of suspicious/unclear liver lesions <input type="checkbox"/> chest X-ray, if suspicious-> chest CT <input type="checkbox"/> after staging: case review at multidisciplinary tumor conference <ul style="list-style-type: none"> <input type="checkbox"/> if albumin <30 g/l: presentation at nutrition clinic <input type="checkbox"/> consent for anesthesia (including epidural catheter), additional exams on demand | <ul style="list-style-type: none"> <input type="checkbox"/> laboratory (blood count, electrolytes, liver- and kidney-specific values, coagulation; CEA, CA 19-9, CA 72-4 if not done pre-admission) <input type="checkbox"/> crossmatch blood and prepare 2 RCC <input type="checkbox"/> ECG if not already performed at pre-admission | <p><i>Intraoperative monitoring:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> BP/HR <input type="checkbox"/> Relaxation <input type="checkbox"/> Body temperature (aim >36°C) <input type="checkbox"/> BS (target 120-200 mg/dl) every hour, correct with infusion of 5%-glucose or insulin bolus <input type="checkbox"/> FiO₂ (desired value 0,7) <input type="checkbox"/> CVP <p><i>Postoperative</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> intermediate care unit <input type="checkbox"/> monitor BP/HR <input type="checkbox"/> monitor urinary excretion <input type="checkbox"/> monitor surgical drains/epidural anesthesia <ul style="list-style-type: none"> <input type="checkbox"/> blood sugar measurements (target 150 mg/dl) <input type="checkbox"/> at night: small laboratory routine, blood count and coagulation <input type="checkbox"/> chest X-ray after central venous catheter insertion | <p><i>Daily:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> monitor BP/HR/temperature three times a day. <input type="checkbox"/> check target drains <input type="checkbox"/> wound control (after POD 2) <p><i>1st postoperative day:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> transfer to general ward, if possible <input type="checkbox"/> blood count, electrolytes, kidney-specific values, coagulation, CRP <p><i>3st postoperative day:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> blood count, electrolytes, kidney-specific values, | <ul style="list-style-type: none"> <input type="checkbox"/> monitor BP/HR/temperature twice a day. <input type="checkbox"/> check target drains <input type="checkbox"/> wound control/ change dressings <p><i>5th postoperative day:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> oral toluidine blue swallowing test <p><i>6th postoperative day:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> blood count, electrolytes, kidney-specific values, coagulation, CRP | <ul style="list-style-type: none"> <input type="checkbox"/> Monitoring RR/HF/Temp. morgens | <ul style="list-style-type: none"> <input type="checkbox"/> medical history <input type="checkbox"/> clinical examination <input type="checkbox"/> temperature <input type="checkbox"/> if necessary adjuvant therapy <input type="checkbox"/> vitamin B12-depot substitution every 2-3 months I.M. <input type="checkbox"/> after splenectomy: vaccination with Pneumovax 23, Mencevax ACWY, Act-HiB |

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| | <input type="checkbox"/> define date of admission/surgery (patient management) | | coagulation, CRP | | |
| ANAESTHESIA | <input type="checkbox"/> cefazolin 2g IV (in case of allergy ciprofloxacin 400 mg IV) / metronidazole 500 mg IV <u>30-60 minutes before surgery</u> | | | | |
| | <input type="checkbox"/> prewarming <input type="checkbox"/> general anesthesia | | <u>1st postoperative day:</u> | | |
| LINES | | | <input type="checkbox"/> if applicable remove arterial cannula before transfer to general ward | | |
| | <input type="checkbox"/> G16 venous cannula <input type="checkbox"/> central venous catheter <input type="checkbox"/> arterial cannulation <input type="checkbox"/> nasogastric tube <input type="checkbox"/> epidural anesthesia (Th 8-10) | | <input type="checkbox"/> removal of nasogastric tube <u>3rd postoperative day:</u> | <u>6th postoperative day</u> | <u>Family doctor (after POD 10)</u> |
| | | | <input type="checkbox"/> remove thoracic epidural catheter (in the morning of day 3 after surgery) | <input type="checkbox"/> remove central venous catheter | <input type="checkbox"/> removal of wound staples |
| FOLEY CATHETER | | | <u>1st postoperative day:</u> | | |
| | <input type="checkbox"/> insertion of transurethral foley catheter before surgery | | <input type="checkbox"/> remove transurethral foley catheter (in the morning of day 1 after surgery) | | |
| DRAINS | | | | | |

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| <p>NUTRITIO N</p> | <ul style="list-style-type: none"> <input type="checkbox"/> balanced diet <input type="checkbox"/> supplementary nutrition as required (nutrition clinic) | <ul style="list-style-type: none"> <input type="checkbox"/> balanced diet <input type="checkbox"/> supplementary nutrition as required (nutrition clinic) | <ul style="list-style-type: none"> <input type="checkbox"/> sweetened tea up to two hours prior to surgery <input type="checkbox"/> after surgery: fasting | <ul style="list-style-type: none"> <input type="checkbox"/> 1 EF on esophagojejunostomy (facultative) | <p><u>1st postoperative day:</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> water/ tea in sips <p><u>2nd+ 3rd postoperative day:</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> drinking quantity >2000 ml | <p><u>5th postoperative day</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Removal of EF in case of negative blue test and amylase <250 U/l in drain fluid <p><u>4th postoperative day</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> Shakes <input type="checkbox"/> drinking at will (quantity >2000 mL) <p><u>5th postoperative day</u></p> <p>in case of negative blue test:</p> <ul style="list-style-type: none"> <input type="checkbox"/> shakes <input type="checkbox"/> oatmeal <input type="checkbox"/> drinking quantity >2000 ml <p><u>6th postoperative day</u></p> <ul style="list-style-type: none"> <input type="checkbox"/> mushy-gastrectomy-diet (rich in protein, low in fat, easily digestible carbohydrates) | <ul style="list-style-type: none"> <input type="checkbox"/> balanced gastrectomy-diet (rich in protein, low in fat, easily digestible carbohydrates) | <ul style="list-style-type: none"> <input type="checkbox"/> balanced gastrectomy-diet (rich in protein, low in fat, easily digestible carbohydrates) |
| | <ul style="list-style-type: none"> <input type="checkbox"/> | | | | | | | |

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| <p>IV MANAGEMENT</p> | <p><input type="checkbox"/> maintain normovolaemia during surgery</p> <p><input type="checkbox"/> Intraoperative/postanaesthesia care unit /IMC: glucose G5% IV if blood sugar <120 mg/dl, insulin perfusor, glucose G5% IV if blood sugar >160 mg/dl (according to endocrinological consultation)</p> <p><input type="checkbox"/> Postoperative fluid management according to CVP (target <5 cmH₂O)</p> | <p><input type="checkbox"/> according to fluid balance target: 2500ml in 24 hours (total volume)</p> | <p><u>7th postoperative day</u></p> <p><input type="checkbox"/> balanced gastrectomy-diet (rich in protein, low in fat, easily digestible carbohydrates)</p> | <p><input type="checkbox"/> according to fluid balance</p> <p><input type="checkbox"/> parenteral supplemental nutrition (1500ml in 24 hours) [only until 6 POD]</p> | <p><input type="checkbox"/> none</p> | | |
| <p>DEFECATION</p> | <p><input type="checkbox"/> continue medication</p> <p><input type="checkbox"/> stop coagulation inhibitors, in case of warfarin or direct oral anticoagulants:</p> | <p><input type="checkbox"/> home medication with stated restrictions</p> | <p><u>Before surgery:</u></p> <p><input type="checkbox"/> home medication up to two hours before surgery</p> | <p><input type="checkbox"/> magnesium 5 mmol/l as solution po tid until first defecation</p> <p><input type="checkbox"/> enema in case of unsuccessful defecation until POD 3</p> | <p><input type="checkbox"/></p> | | |
| <p>MEDICATION</p> | <p><input type="checkbox"/> continue medication</p> <p><input type="checkbox"/> stop coagulation inhibitors, in case of warfarin or direct oral anticoagulants:</p> | <p><input type="checkbox"/> home medication with stated restrictions</p> | <p><u>Before surgery:</u></p> <p><input type="checkbox"/> home medication up to two hours before surgery</p> | <p><u>1st + 2nd postoperative day:</u></p> | <p><input type="checkbox"/> home medication with stated restrictions</p> | <p><input type="checkbox"/> home medication</p> <p><input type="checkbox"/> pantoprazole 40 mg p.o. 1-</p> | <p><input type="checkbox"/> home medication, restart anticoagulant</p> |

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| <p>Fraxiparine 0,1/ 10 kg body weight bid</p> <p><input type="checkbox"/> continue Aspirin in case of corresponding medical history</p> <p><input type="checkbox"/> Stop oral antidiabetic medication on admission day (Metformin 48h prior to surgery)</p> <p><input type="checkbox"/> If splenectomy is planned: vaccination with Pneumovax 23, Mencevax ACWY, Act-HiB >14 days before surgery</p> | <p><input type="checkbox"/> Pantoprazole 40mg 1-0-0</p> <p><input type="checkbox"/> if quick less 70 %, 10mg Konakion® per day for 3 days i.v.</p> <p><input type="checkbox"/> BS (target 120-200 mg/dl) 1</p> <p><input type="checkbox"/> insulin scheme: BS 180-210: +2 iE; BS 210-240: +3 iE; BS 240-270: +4 iE BS 300-350: +6 iE BS 350-400: +8 iE basal insulin sc</p> <p><input type="checkbox"/> in case of full anticoagulation and planned thoracic EDC: Fraxiparine 0,1 / 10 kg body weight only in the morning</p> | <p>(consider above mentioned exceptions)</p> <p><input type="checkbox"/> premedication as recommended by anesthesiologist</p> <p><input type="checkbox"/> Pantoprazole 40mg 1-0-0 i.v.</p> <p><input type="checkbox"/> in the morning: no Fraxiparine</p> | <p><input type="checkbox"/> home medication with stated restrictions</p> <p><input type="checkbox"/> if quick less 70 %, 10mg Konakion® per day for 3 days I.V.</p> <p><input type="checkbox"/> BS (target 120-200 mg/dl)</p> <p><input type="checkbox"/> insulin scheme: BS 180-210: +2 iE; BS 210-240: +3 iE; BS 240-270: +4 iE BS 300-350: +6 iE BS 350-400: +8 iE basal insulin sc</p> <p><input type="checkbox"/> pantoprazole 40 mg p.o. 1-0-0 (in case of subtotal resection)</p> <p><input type="checkbox"/> Fraxiparine 0,3 ml sc 0-0-1 (in case of full anticoagulation: Fraxiparine 0,1 / 10 kg body weight twice a day</p> <p><input type="checkbox"/> in case of soft pancreas tissue or small duct (< 3 mm):</p> | <p><input type="checkbox"/> pantoprazole 40 mg p.o. 1-0-0 (in case of subtotal resection)</p> <p><input type="checkbox"/> insulin scheme: BS 180-210: +2 iE; BS 210-240: +3 iE; BS 240-270: +4 iE BS 300-350: +6 iE BS 350-400: +8 iE basal insulin sc</p> <p><input type="checkbox"/> Fraxiparine 0,3 ml sc 0-0-1 (in case of full anticoagulation: Fraxiparine 0,1 / 10 kg body weight twice a day; in case planned removal the next day no Fraxiparine at nighttime</p> <p><input type="checkbox"/> pancreatic enzymes 3 x 25000 iE in case of steatorrhea</p> | <p>0-0 (in case of subtotal resection)</p> <p><input type="checkbox"/> Fraxiparine 0,3 ml sc 0-0-1 (in case of full anticoagulation: Fraxiparine 0,1 / 10 kg body weight twice a day</p> <p><input type="checkbox"/> pancreatic enzymes 3 x 25000 iE in case of steatorrhea</p> | <p>medication 14 days after surgery</p> <p><input type="checkbox"/> pancreatic enzymes 3 x 25000 iE in case of steatorrhea</p> <p><input type="checkbox"/> vitamin B12-depot substitution every 2-3 months I.M. (depending on drug level)</p> |
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| TRANSFUSION | <input type="checkbox"/> if Hb <8 g/dl or cardiopulmonary disorders | Octreotide 3 x 100 µg sc <input type="checkbox"/> pancreatic enzymes 3 x 25000 iE in case of steatorrhea <input type="checkbox"/> if Hb <8 g/dl or cardiopulmonary disorders | <input type="checkbox"/> if Hb <8g/dl or cardiopulmonary disorders | <input type="checkbox"/> on demand metamizole p.o. | <input type="checkbox"/> on demand metamizole p.o. |
| ANALGESIA | <p><u>Intraoperative</u></p> <input type="checkbox"/> metamizole 1 g I.V. <p><u>Postoperative</u></p> <input type="checkbox"/> metamizole 1 g I.V. 1-1-1-1 <input type="checkbox"/> if needed on top: Perfalgan® 1 g I.V. 1-1-1-1 <input type="checkbox"/> piritramide 7,5 mg IV only in case of failed epidural anesthesia | <p><u>1st postoperative day:</u></p> <input type="checkbox"/> metamizole 1 g I.V 1-1-1-1 <input type="checkbox"/> if needed on top: Perfalgan® 1 g I.V. 1-1-1-1 <input type="checkbox"/> piritramide 7,5 mg IV only in case of failed epidural anesthesia | <input type="checkbox"/> to avoid | <input type="checkbox"/> on demand metamizole p.o. | <input type="checkbox"/> on demand metamizole p.o. |
| intravenous | | <p><u>from 2nd postoperative day:</u></p> <p>Pain ladder</p> <p>Step 1: metamizole 4x1 g p.o, on demand. paracetamol 4x1g p.o.</p> <p>Step 2: additional oxycodone/naloxone 10/5 mg p.o., oxycodone</p> | <p><u>from 2nd postoperative day:</u></p> <p>Pain ladder</p> <p>Step 1: metamizole 4x1 g p.o, on demand. paracetamol 4x1g p.o.</p> <p>Step 2: additional oxycodone/naloxone 10/5 mg p.o., oxycodone</p> | <input type="checkbox"/> on demand metamizole p.o. | <input type="checkbox"/> on demand metamizole p.o. |
| oral | | | | <input type="checkbox"/> on demand metamizole p.o. | <input type="checkbox"/> on demand metamizole p.o. |

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| EPIDURAL CATHETER | 5-10 mg on demand | 5-10 mg on demand | <i>Step 3:</i> pain consultation | <i>Step 3:</i> pain consultation | |
| REHAB | <input type="checkbox"/> thoracic epidural delivery pump: ropivacaine 0,2% + 20 µg sufentanil epidural (46 ml ropivacaine 0,2% + 4 ml sufentanil epidural = 0,4 µg sufentanil/ml), 3-7 ml/h | oxycodone/nalo xone 5/2,5 mg at age>75 <input type="checkbox"/> thoracic epidural catheter (T8-10) as stated before <input type="checkbox"/> remove thoracic epidural catheter in the morning of day 3 after surgery (in case of full anticoagulation pause Fraxiparine 24h before removal and 2-4h thereafter) | oxycodone/nalo xone 5/2,5 mg at age>75 | <input type="checkbox"/> request rehabilitation treatment, when no adjuvant treatment is planned | <input type="checkbox"/> inquire about rehabilitation treatment |
| QUALITY MANAGEM ENT/ MEDICAL REPORT/ | <input type="checkbox"/> collect tissue samples for research <input type="checkbox"/> request pathology report (surgeon) <input type="checkbox"/> brief operation report (surgeon) | <input type="checkbox"/> check pathology report <input type="checkbox"/> case review at multidisciplinary | <input type="checkbox"/> hand discharge letter to patient <input type="checkbox"/> hand chart to chief | | |

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| <p>DRG (diagnosis related groups)</p> | | | <p><input type="checkbox"/> detailed operation report (written by surgeon)</p> | | <p>y tumor conference <input type="checkbox"/> prepare discharge letter for referring physicians (including postoperative recommendatio ns and post discharge appointment)</p> | <p>resident for DRG coding</p> | | |
| <p>INFORMAT ION AND CONSENT</p> | <p><input type="checkbox"/> avoid alcohol and smoking 14 days before surgery <input type="checkbox"/> informed consent <input type="checkbox"/> hand out patient brochure</p> | <p><input type="checkbox"/> pre-operation discussion</p> | <p><input type="checkbox"/> information of next-of- kin by surgeon (red sheet)</p> | <p><input type="checkbox"/> inform patient postoperatively</p> | <p><input type="checkbox"/> inform referring physicians</p> | <p><input type="checkbox"/> final discussion with patient and next-of- kin (histological result and postoperative recommendati ons) <input type="checkbox"/> phone call to referring physician</p> | <p><input type="checkbox"/> discuss histological result and further recommendati ons with patient (if not happened before), communicate further appointments</p> | |
| <p>NURSING patient admission/ discharge</p> | | <p><input type="checkbox"/> PAT-admission + information <input type="checkbox"/> PAT-history <input type="checkbox"/> „red sheet “: next-of-kin phone number</p> | | <p><i>Postoperative:</i> <input type="checkbox"/> PAT-information <input type="checkbox"/> counseling/guidance <input type="checkbox"/> effectuation of orders from operative report</p> | | <p><input type="checkbox"/> prepare discharge documents <input type="checkbox"/> schedule outpatient follow-up appointment on day 8 after surgery <input type="checkbox"/> discharge talk</p> | <p><input type="checkbox"/> patient discharge</p> | |
| <p>medical round / elab- oration</p> | | <p><input type="checkbox"/> participation in ward round</p> | <p><input type="checkbox"/> participation in ward round</p> | <p><input type="checkbox"/> participation in ward round</p> | <p><input type="checkbox"/> participation in ward round</p> | <p><input type="checkbox"/> participation in ward round</p> | | |

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| documentation | <input type="checkbox"/> effectuation of ward round orders <input type="checkbox"/> print laboratory results | <input type="checkbox"/> effectuation of ward round orders <input type="checkbox"/> print laboratory results | <input type="checkbox"/> effectuation of ward round orders <input type="checkbox"/> print laboratory results <input type="checkbox"/> document secondary diagnosis (DRG form) | <input type="checkbox"/> effectuation of ward round orders <input type="checkbox"/> document secondary diagnosis (DRG form) | <input type="checkbox"/> effectuation of ward round orders <input type="checkbox"/> printout of laboratory results <input type="checkbox"/> document secondary diagnosis (DRG form) |
| patient care | <input type="checkbox"/> insert CP sheet into inpatient chart | <input type="checkbox"/> insert CP sheet into inpatient chart | <input type="checkbox"/> document secondary diagnosis (DRG form) <input type="checkbox"/> document nursing activities | <input type="checkbox"/> document secondary diagnosis (DRG form) <input type="checkbox"/> document nursing activities <input type="checkbox"/> care according to nursing standard | <input type="checkbox"/> document secondary diagnosis (DRG form) <input type="checkbox"/> document nursing activities <input type="checkbox"/> care according to nursing standard <input type="checkbox"/> drug administration |
| mobilization/ physiotherapy | <input type="checkbox"/> care according to nursing standard <input type="checkbox"/> drug administration | <input type="checkbox"/> care according to nursing standard <input type="checkbox"/> drug administration | <input type="checkbox"/> drug administration <input type="checkbox"/> BT (spirometer prophylaxis, expectorant, Pine menthol) <input type="checkbox"/> thromboprophylaxis | <input type="checkbox"/> BT (spirometer prophylaxis, expectorant, Pine menthol) <input type="checkbox"/> thromboprophylaxis <input type="checkbox"/> schedule discharge appointment at outpatient diabetes clinic | <input type="checkbox"/> care according to nursing standard <input type="checkbox"/> drug administration <input type="checkbox"/> BT (spirometer prophylaxis, expectorant, Pine menthol) <input type="checkbox"/> thromboprophylaxis |
| patient control | | <input type="checkbox"/> mobilization: 5 h after surgery to edge of bed depending on age/GH/time | <input type="checkbox"/> mobilization: >4h out of bed; walk on aisle twice, | <input type="checkbox"/> complete mobilization (in bed only during nap and at night) | <input type="checkbox"/> complete mobilization (in bed only during nap and at night) |

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| wound/dra ins | | | depending on age/ GH | <input type="checkbox"/> PT in case of COPD, impaired mobility, prolonged bedriddenness | | |
| | <input type="checkbox"/> vital signs (HR, BP, temperature) <input type="checkbox"/> pain intensity (1-10) | <input type="checkbox"/> vital signs (HR, BP, temperature) <input type="checkbox"/> pain intensity (1-10) | <input type="checkbox"/> PT in case of COPD, impaired mobility, prolonged bedriddenness <input type="checkbox"/> vital signs (HR, BP, temperature, breathing) <input type="checkbox"/> pain intensity (1-10) | <input type="checkbox"/> PT in case of COPD, impaired mobility, prolonged bedriddenness <input type="checkbox"/> vital signs (HR, BP, temperature) <input type="checkbox"/> pain intensity (1-10) | <input type="checkbox"/> vital signs (HR, BP, temperature) <input type="checkbox"/> pain intensity (1-10) <input type="checkbox"/> change wound dressing <input type="checkbox"/> remove drain after order | <input type="checkbox"/> vital signs (HR, BP, temperature) <input type="checkbox"/> pain intensity (1-10) <input type="checkbox"/> remove wound staples after order |

AC = anticoagulation, AP = alkaline phosphatase, BP = blood pressure, BT = breathing therapy, BS = blood sugar, ca. = circa, CRP = C-reactive protein, CVP = central venous pressure, DRG = diagnosis related groups, ECG = electrocardiogram, EDC = epidural catheter, EF = Easyflow-Drain, G = Gauge, GH = general health, HPB = hepato-pancreatico-biliary, HR = heart rate, I.V. = intravenous, I.M. = intramuscularly, PAT = patient, POD = postoperative day, PPPD = pylorus-preserving pancreaticoduodenectomy, PT = physiotherapy, RCC = red cell concentrate, RT=respiratory therapy, sc = subcutaneous. This clinical pathway does not absolve therapists from their responsibility of impact, adverse effect, dosage, contraindications of substances for patients. Recommended dosage is for normal weight adults without contraindications.



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