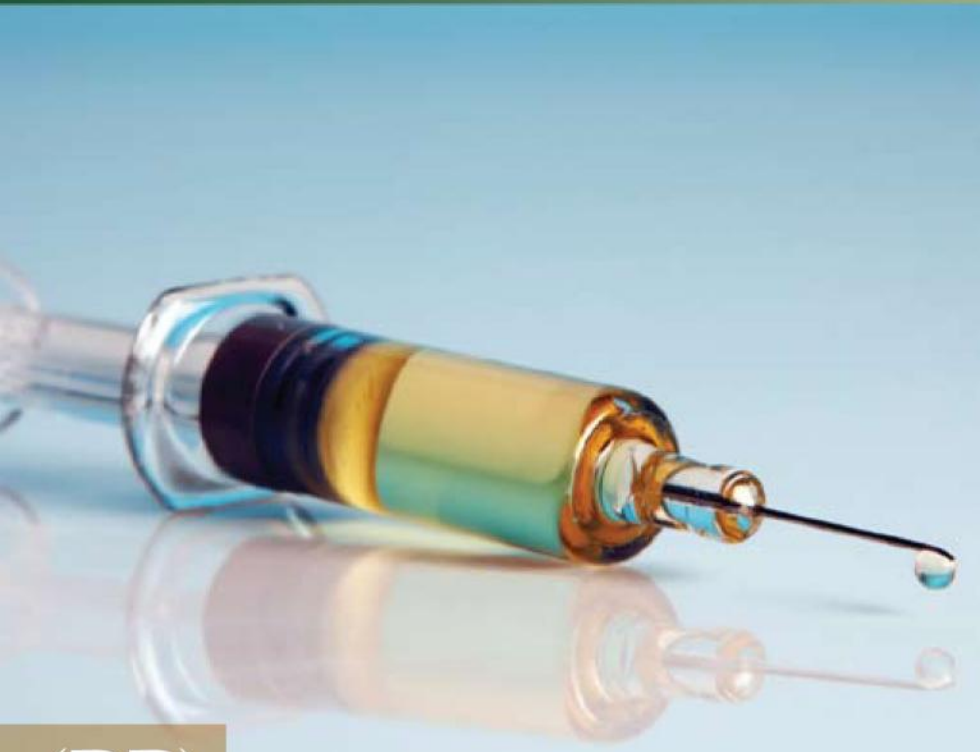
Injectable Drugs Guide

Alistair Gray, Jane Wright, Vincent Goodey and Lynn Bruce



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Alistair Gray
BSc(Hons) MRPharmS DipClinPharm
Clinical Services Lead Pharmacist
East Lancashire Hospitals NHS Trust, UK

Jane Wright
BSc(Hons) MRPharmS DipClinPharm
Lead Pharmacist
Lancashire Care NHS Foundation Trust, UK

Vincent Goodey
BSc(Hons) MRPharmS MSc
Deputy Director of Pharmacy
East Lancashire Hospitals NHS Trust, UK

Lynn Bruce
BSc MRPharmS DipClinPharm
Pharmacy Team Leader
Medical Assessment Unit, Royal Blackburn Hospital
East Lancashire Hospitals NHS Trust, UK

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Preface

The *Injectable Drugs Guide* provides a user-friendly, single point of reference for healthcare professionals in the prescribing, preparation, administration and monitoring of injectable medicines.

The idea for such a book grew out from some of the entries in our sister book *Clinical Pharmacy Pocket Companion,* which, as well as covering many clinical topics such as electrolyte disturbances and perioperative management of medicines, also deals with a number of medicines requiring therapeutic monitoring. It became apparent that the benefits of such an approach could be rolled out to a greater number of medicines. At around the same time the UK National Patient Safety Agency issued a patient safety alert entitled 'Promoting safer use of injectable medicines' (NPSA/2007/20). This requires organisations to risk assess individual parenteral drugs and put procedures in place to allow them to be handled more safely.

The *Injectable Drugs Guide* is a handbook supporting the risk assessment process (each drug has a risk rating). It also provides a holistic approach to injectable medicines to meet the needs of the many disciplines involved in the clinical use of injectables and also those providing advice about injectable drug use.

The book comprises primarily individual drug monographs. There are a number of appendices giving further guidance on specific aspects of injectable therapy and additional clinical information (the full list of these is found on the Contents page).

In the main, cancer chemotherapy agents are not covered in the monographs. This is because there are tight controls around the use of these agents in clinical practice. Their handling in clinical settings is highly protocol driven and locality specific; use by inexperienced individuals is inappropriate.

Alistair Gray
Jane Wright
Vince Goodey
Lynn Bruce
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How to use the *Injectable Drugs Guide* monographs

Each monograph is presented in a format that sequences the information as needed by healthcare professionals from *contemplation* of treatment, through preparation and administration, to the monitoring that may be required during and after therapy. Monographs are generally presented in the following order:

Drug name and form(s) of the preparation(s)

Background information about each medicine including,

- Type of drug
- What it is used to treat (licensed and unlicensed indications and routes)
- Additional miscellany of interest to the user
- If appropriate, how doses of the drug are usually expressed

Pre-treatment checks including,

- Contraindications and cautions to be considered prior to use
- Any measures and/or tests that should be undertaken before commencing therapy. In some cases these tests are mandatory; in others they are dependent on the circumstances in which the drug is being used. These are listed alphabetically.
- Pregnancy and breast-feeding information has not been included except in a few special cases (standard reference sources or the advice of a Medicines Information department should be sought if this information is needed).

Dose including indication-specific information and any adjustments required in renal or hepatic impairment. Unless otherwise stated, doses are for adults (child and neonatal doses have not been included).

Routes of administration

- A series of headings outline the route(s) by which a particular drug may be given; the specifics of preparation and administration are provided for each route. In some cases the individual heading indicates the circumstances in which a particular route is appropriate.
- For drugs given by infusion, most monographs specify the quantity of infusion fluid to use. However, some monographs use the phrase ‘dilute in a suitable volume of compatible infusion fluid’. In this case the prescriber should choose a volume and fluid that is appropriate to the patient’s needs and clinical condition (compatibility data are given further down the monograph in the Technical Information table).

Technical information includes details of:

- **Incompatibilities** with fluids, other drugs by Y-site administration and also sometimes with materials
- **Compatibilities** with infusion fluids and also drugs where co-administration and concentrations are likely to be used in practice. Drugs for which compatibility is concentration-specific are *not* included in this list. More detailed sources such as Trissel[1] should be used to clarify these.
- **pH**, particularly for drugs which are given intravenously
- **Sodium content** is stated if it is ≥1 mmol per likely dose; information about other significant electrolytes is given where appropriate
- **Osmolarity** for the most significantly hyperosmolar products
- **Excipients** where allergy is a possibility or where these could have significant side-effects in certain individuals
- **Storage conditions** advised for long-term and in-use storage plus, in some cases details on the significance of any change in appearance
- **Displacement value** for dry powder products
- **Special handling and management of spillage** information if appropriate
- **Stability after preparation information.** This is *not* provided so that infusions can be prepared significantly prior to use in a clinical area, but rather to indicate how long a preparation is stable if it is not possible to administer it immediately. Stability information is also provided for reconstituted multidose vials.

Monitoring includes the measures required to ensure the medicine is used safely throughout therapy, the clinical outcome and other parameters that need consideration, e.g. certain adverse effects. The frequency of monitoring of each parameter is stated and the rationale for monitoring. In some cases the frequency is precise, e.g. 'daily', in others the frequency is not clearly defined in the literature and an individual clinician will need to decide what is reasonable. In these cases the term 'periodically' has been used.

Additional information includes

Common and serious undesirable effects including:

- **Immediate adverse reactions** or those that may occur shortly after administration
- **Injection- or infusion-related** adverse events, either due to rapid administration or those which are injection-site related
- **Other adverse reactions**

Pharmacokinetics in the main provides an indication of the elimination half-life of the drug, which can be useful in determining duration of effect. Some monographs provide information on other pharmacokinetic or pharmacodynamic parameters where these might be helpful.

Significant interactions drugs are grouped together under subheadings to give an indication of likely effect of the interaction. These lists are not comprehensive and more detailed sources such as *Stockley's Drug Interactions*[2] should be used if required.

Action in case of overdose gives guidance on managing *therapeutic* overdose of the drug and in most cases lists general supportive measures required. For the management of significant overdose an on-line source such as Toxbase[3] should always be consulted.

Counselling points are intended to provide a prompt for healthcare professionals as they speak to patients about their therapy.

Risk rating. Each medicine has been risk-assessed, considering the worst case scenario, to provide an overall risk rating based on the NPSA tool for risk assessment of individual injectable medicine products prepared in clinical areas.[4] The assessment is displayed pictorially with icons and as a risk score. See Appendix 11 for more information on the risk rating used.

References. In general the main reference source used to assemble the information has been the manufacturer's product literature (in the UK this is the Summary of Product Characteristics or SPC) and MedicinesComplete (see below). In the main, SPCs mentioned can be accessed on-line at http://www.medicines.org.uk/EMC/. To save space references have not been included if information has been sourced from MedicinesComplete, although the SPCs used have been stated for clarity. Any other reference source used is stated in the normal way using the Vancouver system of referencing.

References

1. Trissel L, ed. *Handbook on Injectable Drugs*, 14th edn. Bethesda, MD: American Society of Health-System Pharmacists, 2007 (accessible via MedicinesComplete).
2. Baxter K, ed. *Stockley's Drug Interactions 9* (accessible via MedicinesComplete).
3. Toxbase accessible at http://www.toxbase.org.
4. National Patient Safety Agency. *Promoting safer use of injectable medicines* (NPSA/2007/20) (accessible at www.npsa.nhs.uk/health/alerts).

Feedback

Feedback on any aspect of the book would be welcome via the e-mail address pharmpresseditorial@rpharms.com.

About the authors

Lynn Bruce studied pharmacy at Aston University. The first 20 years of her working life were based in secondary care variously as MI pharmacist, clinical pharmacy lead, clinical economist and latterly in various management positions. She migrated across the divide to primary care in 1997 becoming PCG and then PCT prescribing advisor. Hospital clinical pharmacy beckoned her back to secondary care in 2002: she is now Pharmacy Team Leader on the Medical Assessment Unit at the Royal Blackburn Hospital.

Lynn is married and, when she's not writing pharmacy books, loves studying wildlife and travelling and is addicted to puzzles of all types.

Vince Goodey graduated in 1985 from the London School of Pharmacy, and has since worked primarily in the hospital sector in clinical and managerial roles. As a postgraduate Vince studied at the University of Manchester to attain an MSc in Pharmacy Practice in 1996.

Although hailing originally from Essex, Vince is currently Deputy Director of Pharmacy at East Lancashire Hospitals NHS Trust.

Alistair Gray is from Sunderland. He studied pharmacy at Sunderland Polytechnic, graduating in 1988 with first-class honours, and then completed his pre-registration year with Boots in Newcastle-upon-Tyne. He continued working for Boots in a variety of pharmacy and store management positions in the North West of England. In 2002 he changed disciplines and became Community Services pharmacist at Queens Park Hospital in Blackburn. He completed a Diploma in Clinical & Health Services Pharmacy at the University of Manchester in 2008 and subsequently became Clinical Services Lead Pharmacist for East Lancashire Hospitals NHS Trust in 2009 based at the now re-named Royal Blackburn Hospital.

Alistair is married with two children and loves spending time with his family. He follows Formula One motor racing closely, enjoys reading, eating out, going to the movies, playing guitar and songwriting.

Jane Wright, after working for 18 years in the Civil Service, attended the University of Manchester to study pharmacy. Jane graduated in 1994 and did her pre-registration year at the Royal Preston Hospital. For the next ten years Jane worked in Blackburn hospitals in a variety of clinical roles, her last being Clinical Services Manager with responsibility for education and training. In 1999 she obtained a Diploma in Clinical & Health Services Pharmacy at the University of Manchester. She moved to Lancashire Care NHS Foundation Trust in April 2005 where she is currently employed as Lead Pharmacist for East Lancashire.

Jane is married and in her spare time enjoys playing with Molly and Polly (two very lively dogs).

Contributors

Catherine Strong MRPharmS DipClinPharm, Lead Clinical Pharmacist (acute medicine) based at Fairfield General Hospital (The Pennine Acute Hospitals NHS Trust), Bury, UK.

Katy Hand BSc(Hons) MRPharmS MSc in Clinical Pharmacy, Critical Care Pharmacist, Southampton General Hospital, Southampton, UK.

Kevin Johnson MRPharmS DipClinPharm, Medical Admissions Unit Pharmacist, Royal Blackburn Hospital, Blackburn, UK.

Joanna Wallett MRPharmS DipClinPharm, Senior Clinical Pharmacist, East Lancashire Hospitals NHS Trust, Royal Blackburn Hospital, Blackburn, UK.

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Abbreviations

↑	increased, raised or hyper- (as in ↑K = hyperkalaemia)
↓	decreased or hypo- (as in ↓K = hypokalaemia)
ABGs	arterial blood gases
ABW	actual bodyweight
ACE	angiotensin-converting enzyme
ACS	acute coronary syndromes
ACT	activated clotting time
ACTH	adrenocorticotrophic hormone, corticotrophin
ADH	anti-diuretic hormone; vasopressin
ADR	adverse drug reaction
AF	atrial fibrillation
AIDS	acquired immune deficiency syndrome
Alk Phos	alkaline phosphatase
ALT	alanine transaminase (alanine aminotransferase)
AML	acute myeloid leukaemia
ANC	absolute neutrophil count
ANTT	aseptic non-touch technique
APTT	activated partial thromboplastin time
ARDS	adult respiratory distress syndrome
AST	aspartate transaminase (aspartate aminotransferase)
AUC	area under the curve
AV	atrioventricular
AZT	azidothymidine (zidovudine)
BAL	British anti-Lewisite (dimercaprol)
BCG	Bacillus Calmette–Guérin
BMD	bone mineral density
BP	blood pressure
bpm	beats per minute
Ca	calcium
CABG	coronary artery bypass graft
CAPD	continuous ambulatory peritoneal dialysis
L-carnitine	levocarnitine
CCPD	continuous cyclic peritoneal dialysis
CHM	Commission on Human Medicines
CHMP	Committee for Medicinal Products for Human Use
CIVAS	Centralised Intravenous Additive Service
CK	creatine kinase, creatine phosphokinase, CPK
CKD	chronic kidney disease

Cl	chloride
CMV	cytomegalovirus
CNS	central nervous system
CO_2	carbon dioxide
COPD	chronic obstructive pulmonary disease
CPR	cardiopulmonary resuscitation
Cr	creatinine
CrCl	creatinine clearance
CRP	C-reactive protein
CSF	cerebrospinal fluid
CSII	continuous subcutaneous insulin infusion
CSM	Committee on Safety of Medicines
cSSTI	complicated skin and soft-tissue infections
CTZ	chemoreceptor trigger zone
CVA	cerebrovascular accident
CVP	central venous pressure
DAFNE	dose adjustment for normal eating
DAS	disease activity score
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
DMARDs	disease-modifying anti-rheumatic drugs
DVT	deep vein thrombosis
ECG	electrocardiogram
ECT	electroconvulsive therapy
EFAD	essential fatty acid deficiency
eGFR	estimated glomerular filtration rate
EMD	electromechanical dissociation
EPSE	extrapyramidal side-effects (e.g. muscle shakes and tremor)
ESR	erythrocyte sedimentation rate
FBC	full blood count
FU	fluorouracil
G6PD	glucose-6-phosphate dehydrogenase
GCS	Glasgow Coma Scale
G-CSF	granulocyte colony-stimulating factor
GFR	glomerular filtration rate
GGT	gamma-glutamyl transpeptidase
GH	growth hormone
GI	gastrointestinal
Gluc	glucose
GORD	gastro-oesophageal reflux disease
GP	glycoprotein
GVHD	graft-versus-host disease
HACA	human anti-chimeric antibody
Hartmann's	Sodium lactate intravenous infusion, compound
Hb	haemoglobin
HbA1c	glycosylated (glycated) haemoglobin
HBV	hepatitis B virus
HCG	human chorionic gonadotrophin
HCO_3	bicarbonate
HDL	high-density lipoprotein
HHS	hyperosmolar hyperglycaemic state (formerly HONS or HONK)
HIPAA	heparin-induced platelet activation assay

HIT	heparin-induced thrombocytopenia
HIV	human immunodeficiency virus
HRT	hormone replacement therapy
HSCT	haematopoietic stem cell transplantation
HSV	herpes simplex virus
IBW	ideal bodyweight (see Appendix 10 for calculation)
IgE	immunoglobulin E
IGF	insulin-like growth factor
IgG	immunoglobulin G
IHD	ischaemic heart disease
IM	intramuscular
INR	international normalised ratio
IV	intravenous
JVP	jugular venous pressure
K	potassium
KCl	potassium chloride
KGF	human keratinocyte growth factor
LDL	low-density lipoprotein
LFTs	liver function tests
LHRH	luteinising hormone releasing hormone
LMWH	low-molecular-weight heparin
LRTI	lower respiratory tract infection
LVEF	left-ventricular ejection fraction
LVF	left ventricular failure
MAOI	monoamine oxidase inhibitor
MCV	mean cell volume
Mg	magnesium
MHRA	Medicines and Healthcare products Regulatory Agency
MI	myocardial infarction
MIC	minimum inhibitory concentration
min	minute
mmHg	millimetres of mercury (used in blood pressure readings)
MRSA	methicillin-resistant *Staphylococcus aureus*
Na	sodium
NaCl	sodium chloride
NBM	nil by mouth
NG	nasogastric
NICE	National Institute for Health and Clinical Excellence
NIHSS	NIH Stroke Scale
NMS	neuroleptic malignant syndrome e.g. hyperthermia, muscle rigidity & altered consciousness
NPIS	National Poisons Information Service (tel: 0844 892 0111)
NPSA	National Patient Safety Agency
NQMI	non-Q wave myocardial infarction
NRTI	nucleoside reverse transcriptase inhibitor
NSAID	non-steroidal anti-inflammatory drug
NSTEMI	non ST-segment elevation myocardial infarction
NYHA	New York Heart Association
O_2	oxygen
OHSS	ovarian hyperstimulation syndrome
PA	tissue plasminogen activator
PBPC	peripheral blood progenitor cell

PCA	patient-controlled analgesia
PCI	percutaneous coronary intervention
PCV	packed cell volume
PE	pulmonary embolism
PE	phenytoin sodium equivalents *(only in the Fosphenytoin monograph)*
PEA	pulseless electrical activity
PICC	peripherally inserted central intravenous catheter
PML	progressive multifocal leucoencephalopathy
PN	parenteral nutrition
PO_4	phosphate
PONV	postoperative nausea and vomiting
PPH	primary pulmonary hypertension
PPI	proton pump inhibitor
PRCA	pure red cell aplasia
PSA	prostate-specific antigen
PT	prothrombin time
PTH	parathyroid hormone
PVC	poly(vinyl chloride)
r-DNA	recombinant DNS
RIE	right-sided infective endocarditis
Ringer's	Ringer's solution for injection
SA	sinoatrial
SBECD	sulfobutylether beta cyclodextrin sodium
SC	subcutaneous
SIADH	syndrome of inappropriate ADH secretion
SLE	systemic lupus erythematosus
SPC	summary of product characteristics
STEMI	ST-segment elevation myocardial infarction
SVT	supraventricular tachycardia
T_3	tri-iodothyronine; liothyronine
T_4	tetra-iodothyronine; levothyroxine
TFTs	thyroid function tests
TIA	transient ischaemic attack
TIH	tumour-induced hypercalcaemia
TIVAD	totally implantable venous access device
TNF	tumour necrosis factor
TPN	total parenteral nutrition
TRH	thyrotrophin-releasing hormone
TSH	thyroid-stimulating hormone, thyrotrophin
U	urea
UA	unstable angina
U&Es	urea and electrolytes
UFH	unfractionated heparin
ULN	upper limit of normal
VEP	visual evoked potentials
VT	ventricular tachycardia
VTE	venous thromboembolism
WCC	white cell count
WFI	water for injections
WPW	Wolff–Parkinson–White syndrome