

## **Summary of Product Characteristics**

### **1. Name of the medicinal product**

Toradol injection (Ketorolac tromethamine 30 mg/ml solution for injection)

### **2. Qualitative and quantitative composition**

Each ampoule contains 30 mg of ketorolac Tromethamine in 1 ml of solution.

#### **Excipient(s) with known effect:**

1 ml of solution for injection contains approximately 1.71 mg sodium.

Ketorolac Tromethamine 30mg/ml solution for injection contains a small amount of ethanol (alcohol), 100 mg per dose.

For a full list of excipients, see section 6.1.

### **3. Pharmaceutical form**

Solution for injection

A clear to slightly yellow solution for intramuscular or bolus intravenous injection pH of the solution is between 6.90 and 7.90.

### **4. Clinical particulars**

#### **4.1. Therapeutic indications**

Ketorolac Tromethamine 30mg/ml solution for injection is indicated for the short-term management of moderate to severe acute post-operative pain.

Treatment should only be initiated in hospitals. The maximum duration of treatment is two days.

#### **4.2. Posology and method of administration**

Ketorolac Tromethamine 30mg/ml solution for injection is for administration by intramuscular or bolus intravenous injection. Bolus intravenous doses should be given over no less than 15 seconds. Ketorolac Tromethamine 30mg/ml solution for injection should not be used for epidural or spinal administration.

The time to onset of analgesic effect following both IV and IM administration is and is approximately 30 minutes, with maximum analgesia occurring within one to two hours. The median duration of analgesia is generally four to six hours.

Dosage should be adjusted according to the severity of the pain and the patient response.

The administration of continuous multiple daily doses of ketorolac intramuscularly or intravenously should not exceed two days because adverse events may increase with prolonged usage. There has been limited experience with dosing for longer periods since the vast majority of patients have transferred to oral medication, or no longer require analgesic therapy after this time.

Undesirable effects may be minimized by using the lowest effective dose for the shortest duration necessary to control symptoms (see section 4.4).

#### **Adults**

The recommended initial dose of Ketorolac injection is 10mg, followed by 10 to 30mg every four to six hours as required. In the initial post-operative period, Ketorolac Tromethamine 30mg/ml solution for injection may be given as often as every two hours if needed. The lowest effective dose should be

given. A total daily dose of 90mg for non-elderly and 60mg for the elderly, renally-impaired patients and patients less than 50kg should not be exceeded. The maximum duration of treatment should not exceed two days.

Reduce dosage in patients under 50kg.

Opioid analgesics (e.g. morphine, pethidine) may be used concomitantly, and may be required for optimal analgesic effect in the early post-operative period when pain is most severe. Ketorolac does not interfere with opioid binding and does not exacerbate opioid-related respiratory depression or sedation. When used in association with Ketorolac Tromethamine 30mg/ml solution for injection IM/IV, the daily dose of opioid is usually less than that normally required. However, opioid side-effects should still be considered, especially in day-case surgery.

For patients receiving parenteral Ketorolac Tromethamine 30mg/ml solution for injection, and who are converted to Ketorolac Tromethamine oral tablets, the total combined daily dose should not exceed 90mg (60mg for the elderly, renally-impaired patients and patients less than 50kg) and the oral component should not exceed 40mg on the day the change of formulation is made. Patients should be converted to oral treatment as soon as possible.

#### **Older People**

The older people are at increased risk of the serious consequences of adverse reactions. If an NSAID is considered necessary, the lowest effective dose should be used and for the shortest possible duration. The patient should be monitored regularly for GI bleeding during NSAID therapy.

A total daily dose of 60mg should not be exceeded (see section 4.4).

#### **Children**

Safety and efficacy in children have not been established. Therefore, Ketorolac Tromethamine 30mg/ml solution for injection is not recommended for use in children under 16 years of age.

#### **Renal impairment**

Contra-indicated in moderate to severe renal impairment; reduce dosage in lesser impairment (not exceeding 60mg/day IV or IM) (see section 4.3).

### **4.3. Contraindications.**

Ketorolac is contraindicated in patients with previously demonstrated hypersensitivity to Ketorolac, any of its excipients, or other NSAIDs and patients in whom aspirin or other prostaglandin synthesis inhibitors induce allergic reactions (severe anaphylactic-like reactions have been observed in such patients). Such reactions have included asthma, rhinitis, angioedema, or urticaria.

Ketorolac is also contraindicated in

- those with a history of asthma
- children under 16 years of age.

Ketorolac is contraindicated in patients with active or a history of gastrointestinal bleeding or perforation, related to previous NSAIDs therapy. Active or history of recurrent peptic ulcer/haemorrhage (two or more distinct episodes of proven ulceration or bleeding)

As with other NSAIDs, Ketorolac is contraindicated in patients with severe heart failure, hepatic failure and renal failure (see section 4.4).

Ketorolac is contraindicated in patients with moderate or severe renal impairment (serum creatinine >160 µ mol/l) or in patients at risk for renal failure due to volume depletion or dehydration.

Ketorolac is contraindicated in pregnancy, labour, delivery or lactation (see section 4.6).

Ketorolac is contra-indicated as prophylactic analgesia before surgery due to inhibition of platelet aggregation and is contra-indicated intra-operatively because of the increased risk of bleeding.

Ketorolac inhibits platelet function and is, therefore, contraindicated in patients with suspected or confirmed cerebrovascular bleeding, patients who have had operations with a high risk of haemorrhage or incomplete haemostasis and those at high risk of bleeding such as those with haemorrhagic diatheses, including coagulation disorders.

It is also contraindicated in patients on anticoagulants, including warfarin and low dose heparin (2500 - 5000 units 12 hourly).

Ketorolac is contraindicated in patients currently receiving ASA or other NSAIDs (including cyclooxygenase-2 selective inhibitors).

Ketorolac Solution for injection is contraindicated for neuraxial (epidural or intrathecal) administration due to its alcohol content.

The combination of Ketorolac with oxpentifylline is contraindicated. Concurrent treatment with ketorolac and probenecid or lithium salts is contraindicated.

Ketorolac is contra-indicated in patients with the complete or partial syndrome of nasal polyps, angioedema or bronchospasm.

#### **4.4. Special warnings and precautions for use**

***Ketorolac: Epidemiological evidence suggests that ketorolac may be associated with a high risk of serious gastrointestinal toxicity, relative to some other NSAIDs, especially when used outside the licensed indications and/ or for prolonged periods (see also section 4.1, 4.2 and 4.3).***

Physicians should be aware that in some patients pain relief may not occur until upwards of 30 minutes after IV or IM administration.

The use of Ketorolac with concomitant NSAIDs including cyclooxygenase-2 selective inhibitors should be avoided.

Undesirable effects may be minimized by using the lowest effective dose for the shortest duration necessary to control symptoms (see section 4.2 and GI and cardiovascular risks below).

#### ***Gastrointestinal ulceration, bleeding and perforation:***

GI bleeding, ulceration or perforation, which can be fatal, has been reported with all NSAIDs including ketorolac therapy, at anytime during treatment, with or without warning symptoms or a previous history of serious GI events. In a non-randomised, in-hospital post-marketing surveillance study, increased rates of clinically serious GI bleeding were seen in patients < 65 years of age who received an average daily dose of > 90mg ketorolac IM as compared to those patients receiving parenteral opioids.

The elderly have an increased frequency of adverse reactions to NSAIDs, especially gastrointestinal bleeding and perforation which may be fatal. Debilitated patients seem to tolerate ulceration or bleeding less well than

others. Most of the fatal gastrointestinal events associated with non-steroidal anti-inflammatory drugs occurred in the elderly and/or debilitated patients. The risk of GI bleeding, ulceration or perforation is higher with increasing NSAID doses, including Ketorolac IV, in patients with a history of ulcer, particularly if complicated with haemorrhage or perforation, and in the elderly. The risk of clinically serious gastrointestinal bleeding is dose dependent. These patients should commence treatment on the lowest dose available. Combination therapy with protective agents (e.g. misoprostol or proton pump inhibitors) should be considered for these patients, and also for patients requiring concomitant low dose aspirin, or other drugs likely to increase gastrointestinal risk (see section 4.5). This age-related risk of gastrointestinal bleeding and perforation is common to all NSAIDs. Compared to young adults, the elderly have an increased plasma half-life and reduced plasma clearance of ketorolac. A longer dosing interval is advisable (see section 4.2).

NSAIDs should be given with care to patients with a history of inflammatory bowel disease, (ulcerative colitis, Crohn's disease) as these conditions may be exacerbated (see section 4.8). Patients with a history of GI toxicity, particularly when elderly, should report any unusual abdominal symptoms (especially GI bleeding) particularly in the initial stages of treatment. When GI bleeding or ulceration occurs in patients receiving Ketorolac IV, treatment should be withdrawn.

Caution should be advised in patients receiving concomitant medications which could increase the risk of ulceration or bleeding, such as oral corticosteroids, selective serotonin-reuptake inhibitors or anti-platelet agents such as aspirin (see section 4.5).

Use in patients taking anticoagulants such as warfarin is contraindicated (see section 4.3).

As with other NSAIDs the incidence and severity of gastrointestinal complications may increase with increasing dose and duration of treatment with Ketorolac IV. The risk of clinically serious gastrointestinal bleeding is dose-dependent. This is particularly true in elderly patients who receive an average daily dose greater than 60 mg/day of Ketorolac IV. A history of peptic ulcer disease increases the possibility of developing serious gastrointestinal complications during Ketorolac therapy.

***Haematological effects:***

Patients with coagulation disorders should not receive Ketorolac Tromethamine 30mg/ml solution for injection. Patients on anticoagulation therapy may be at increased risk of bleeding if given Ketorolac Tromethamine 30mg/ml solution for injection concurrently. The concomitant use of ketorolac and prophylactic low dose heparin (2500 - 5000 units 12-hourly) and dextrans has not been studied extensively and may also be associated with an increased risk of bleeding. Patients already on anticoagulants or who require low-dose heparin should not receive ketorolac. Patients who are receiving other drug therapy that interferes with haemostasis should be carefully observed if Ketorolac Tromethamine 30mg/ml solution for injection is administered. In controlled clinical studies, the incidence of clinically significant postoperative bleeding was less than 1%.

Ketorolac inhibits platelet aggregation and prolongs bleeding time. In patients with normal bleeding function, bleeding times were raised, but not outside the normal range of two to eleven minutes. Unlike the prolonged effects from aspirin, platelet function returns to normal within 24 to 48 hours after ketorolac is discontinued.

In post-marketing experience, postoperative wound haemorrhage has been reported in association with the peri-operative use of Ketorolac Tromethamine 30mg/ml solution for injection IM/IV. Therefore, ketorolac should not be used in patients who have had operations with a high risk of haemorrhage or incomplete haemostasis. Caution should be used where strict haemostasis is critical, e.g. in cosmetic or day-case surgery, resection of the prostate or tonsillectomy. Haematomas and other signs of wound haemorrhage and epistaxis have been reported with the use of Ketorolac Tromethamine 30mg/ml solution for injection. Physicians should be aware of the pharmacological similarity of ketorolac to other non-steroidal anti-inflammatory drugs that inhibit cyclo-oxygenase and the risk of bleeding, particularly in the elderly.

#### ***Skin reactions***

Serious skin reactions, some of them fatal, including exfoliative dermatitis, Stevens- Johnson syndrome, and toxic epidermal necrolysis, have been reported very rarely in association with the use of NSAIDs (see section 4.8). Patients appear to be at highest risk for these reactions early in the course of therapy: the onset of the reactions occurring in the majority of cases within the first month of treatment. Ketorolac Tromethamine 30mg/ml solution for injection should be discontinued at the first appearance of skin rash, mucosal lesions, or any other sign of hypersensitivity.

#### ***SLE and mixed connective tissue disease:***

In patients with systemic lupus erythematosus (SLE) and mixed connective tissue disorders there may be an increased risk of aseptic meningitis (see section 4.8).

#### ***Sodium/fluid retention in cardiovascular conditions and peripheral oedema***

Caution is required in patients with a history of hypertension and /or heart failure as fluid retention and oedema have been reported in association with NSAID therapy.

Fluid retention, hypertension and peripheral oedema has been observed in some patients taking NSAIDs including Ketorolac and it should therefore be used with caution in patients with cardiac decompensation, hypertension or similar conditions.

#### ***Cardiovascular and cerebrovascular effects***

Appropriate monitoring and advice are required for patients with a history of hypertension and/or mild to moderate congestive heart failure as fluid retention and oedema have been reported in association with NSAID therapy. Clinical trial and epidemiological data suggest that use of coxibs and some NSAIDs (particularly at high doses) may be associated with a small increased risk of arterial thrombotic events (for example myocardial infarction or stroke). Although ketorolac has not shown to increase thrombotic events such as myocardial infarction, there are insufficient data to exclude such a risk for Ketorolac.

Patients with uncontrolled hypertension, congestive heart failure, established ischaemic heart disease, peripheral arterial disease, and/or cerebrovascular disease should only be treated with Ketorolac after careful consideration. Similar consideration should be made before initiating treatment of patients with risk factors for cardiovascular disease (e.g. hypertension, hyperlipidaemia, diabetes mellitus and smoking).

**Cardiovascular, Renal and Hepatic Impairment:**

Caution should be observed in patients with conditions leading to a reduction in blood volume and/or renal blood flow, where renal prostaglandins have a supportive role in the maintenance of renal perfusion. In these patients, administration of an NSAID may cause a dose-dependent reduction in renal prostaglandin formation and may precipitate overt renal failure. Patients at greatest risk of this reaction are those who are volume depleted because of blood loss or severe dehydration, patients with impaired renal function, heart failure, liver dysfunction, the elderly and those taking diuretics. Renal function should be monitored in these patients. Discontinuation of NSAID therapy is typically followed by recovery to the pre-treatment state. Inadequate fluid/blood replacement during surgery, leading to hypovolaemia, may lead to renal dysfunction which could be exacerbated when Ketorolac Tromethamine 30mg/ml solution for injection is administered. Therefore, volume depletion should be corrected and close monitoring of serum urea and creatinine and urine output is recommended until the patient is normovolaemic. In patients on renal dialysis, ketorolac clearance was reduced to approximately half the normal rate and terminal half-life increased approximately three-fold (see section 4.3).

**Renal effects:**

As with other NSAIDs Ketorolac should be used with caution in patients with impaired renal function or a history of kidney disease because it is a potent inhibitor of prostaglandin synthesis. Caution should be observed as renal toxicity has been seen with Ketorolac and other NSAIDs in patients with conditions leading to a reduction in blood volume and/or renal blood flow where renal prostaglandins have a supportive role in the maintenance of renal perfusion.

In these patients administration of Ketorolac or other NSAIDs may cause a dose-dependent reduction in renal prostaglandin formation and may precipitate overt renal decompensation or failure. Patients at greatest risk of this reaction are those with impaired renal function, hypovolaemia, heart failure, liver dysfunction, those taking diuretics and the elderly. Discontinuation of Ketorolac or other non-steroidal anti-inflammatory therapy is usually followed by recovery to the pre-treatment state.

As with other drugs that inhibit prostaglandin synthesis, elevations of serum urea, creatinine and potassium have been reported with ketorolac tromethamine and may occur after one dose.

*Patients with impaired renal function:* Since ketorolac tromethamine and its metabolites are excreted primarily by the kidney, patients with moderate to severe impairment of renal function (serum creatinine greater than 160 micromol/l) should not receive Ketorolac Tromethamine 30mg/ml solution for injection. Patients with lesser renal impairment should receive a reduced dose

of ketorolac (not exceeding 60mg/day IM or IV) and their renal status should be closely monitored.

*Use in patients with impaired liver function:* Patients with impaired hepatic function from cirrhosis do not have any clinically important changes in ketorolac clearance or terminal half-life.

Borderline elevations of one or more liver function tests may occur. These abnormalities may be transient, may remain unchanged, or may progress with continued therapy. Meaningful elevations (greater than 3 times normal) of serum glutamate pyruvate transaminase (SGPT/ALT) or serum glutamate oxaloacetate transaminase (SGOT/AST) occurred in controlled clinical trials in less than 1% of patients. If clinical signs and symptoms consistent with liver disease develop, or if systemic manifestations occur, Ketorolac Tromethamine 30mg/ml solution for injection should be discontinued.

#### ***Anaphylactic (anaphylactoid) reactions***

Anaphylactic (anaphylactoid) reactions (including, but not limited to, anaphylaxis, bronchospasm, flushing, rash, hypotension, laryngeal oedema and angioedema) may occur in patients with or without a history of hypersensitivity to aspirin other NSAIDs or Ketorolac IV. These may also occur in individuals with a history of angioedema, bronchospastic reactivity (e.g. asthma) and nasal polyps. Anaphylactoid reactions, like anaphylaxis, may have a fatal outcome. Therefore, Ketorolac should be used with caution in patients with a history of asthma and in patients with the complete or partial syndrome of nasal polyps, angioedema and bronchospasm.

#### ***Precautions related to fertility***

The use of Ketorolac Tromethamine 30mg/ml solution for injection, as with any drug known to inhibit cyclooxygenase/prostaglandin synthesis, may impair fertility and is not recommended in women attempting to conceive. In women who have difficulty conceiving or are undergoing investigation of fertility, withdrawal of Ketorolac Tromethamine 30mg/ml solution for injection should be considered.

#### ***Fluid retention and oedema***

Fluid retention, hypertension and oedema have been reported with the use of Ketorolac and it should therefore be used with caution in patients with cardiac decompensation, hypertension or similar conditions.

Caution is advised when methotrexate is administered concurrently since some prostaglandin synthesis-inhibiting drugs have been reported to reduce the clearance of methotrexate, and thus possibly enhance its toxicity.

#### ***Pediatric Use:***

Ketorolac tablets are not recommended for use in children. Ketorolac given parenterally is not recommended in children younger than 2 years of age.

#### ***Drug Abuse and Dependence***

Ketorolac is devoid of addictive potential. No withdrawal symptoms have been observed following abrupt discontinuation of Ketorolac IV.

### **4.5. Interaction with other medicinal products and other forms of interaction**

Ketorolac is highly bound to human plasma protein (mean 99.2%) and binding is concentration-independent.

***The following medicinal products are NOT to be co-administered with Ketorolac***

***Tromethamine 30mg/ml solution for injection:***

Ketorolac Tromethamine 30mg/ml solution for injection should not be used with other ASA or other NSAIDs including cyclooxygenase-2 selective inhibitors as the risk of inducing serious NSAID-related adverse events may be increased (see section 4.3).

Ketorolac inhibits platelet aggregation, reduces thromboxane concentrations and prolongs bleeding time. Unlike the prolonged effects from aspirin, platelet function returns to normal within 24-48 hours after Ketorolac is discontinued.

Ketorolac Tromethamine 30mg/ml solution for injection is contraindicated in combination with anti-coagulants, such as warfarin since co-administration of NSAIDs and anticoagulants may cause an enhanced anti-coagulant effect (see section 4.3).

Although studies do not indicate a significant interaction between Ketorolac and warfarin or heparin the concurrent use of Ketorolac and therapy that affects haemostasis, including therapeutic doses of anticoagulation therapy (warfarin) prophylactic low-dose heparin (2500-5000 units 12-hourly) and dextrans may be associated with an increased risk of bleeding.

Inhibition of renal lithium clearance, leading to an increase in plasma lithium concentration, has been reported with some prostaglandin synthesis-inhibiting drugs. Cases of increased lithium plasma concentrations during Ketorolac therapy have been reported.

Probenecid should not be administered concurrently with ketorolac because of increases in ketorolac plasma concentrations and half-life.

NSAIDs should not be used for eight to twelve days after mifepristone administration as NSAIDs can reduce the effects of mifepristone.

***The following medicinal products in combination with Ketorolac Tromethamine 30mg/ml solution for injection are to be co-administered with caution:***

As with all NSAIDs, caution should be taken when co-administering with corticosteroids because of the increased risk of gastro-intestinal ulceration or bleeding (see section 4.4).

There is an increased risk of gastrointestinal bleeding (see section 4.4) when anti-platelet agents and selective serotonin reuptake inhibitors (SSRIs) are combined with NSAIDs.

When ketorolac is administered concurrently with oxpentifylline, there is an increased tendency to bleeding.

Some prostaglandin synthesis-inhibiting drugs have been reported to reduce the clearance of methotrexate, and thus possibly enhance its toxicity.

Ketorolac tromethamine does not alter digoxin protein binding. In vitro studies indicated that at therapeutic concentrations of salicylate (300µg/ml), the binding of ketorolac was reduced from approximately 99.2% to 97.5% representing a potential twofold increase in unbound ketorolac plasma concentrations. Therapeutic concentrations of digoxin, warfarin, ibuprofen, naproxen, piroxicam, acetaminophen, phenytoin and tolbutamide did not alter ketorolac protein binding.



Ketorolac Solution for injection reduced the diuretic response to furosemide in normovolemic healthy subjects by approximately 20% so particular care should be taken in patients with cardiac decompensation.

Co-administration with diuretics can lead to a reduced diuretic effect, and increase the risk of nephrotoxicity of NSAIDs.

As with all NSAIDs caution is advised when ciclosporin is co-administered because of the increased risk of nephrotoxicity.

There is a possible risk of nephrotoxicity when NSAIDs are given with tacrolimus.

NSAIDs may reduce the effect of diuretics and antihypertensive medicinal products. The risk of acute renal insufficiency, which is usually reversible, may be increased in some patients with compromised renal function (e.g. dehydrated patients or elderly patients) when ACE inhibitors and/or angiotensin II receptor antagonists are combined with NSAIDs. Therefore, the combination should be administered with caution, especially in the elderly. Patients should be adequately titrated and consideration should be given to monitoring renal function after initiation of concomitant therapy, and periodically thereafter.

NSAIDs may exacerbate cardiac failure, reduce GFR and increase plasma cardiac glycoside levels when co-administered with cardiac glycosides.

Ketorolac has been shown to reduce the need for concomitant opioid analgesia when it is given for the relief of postoperative pain.

Oral administration of Ketorolac Tablets after a high-fat meal resulted in decreased peak and delayed time-to-peak concentrations of ketorolac by about 1 hour. Antacids did not affect the extent of absorption.

Animal data indicate that NSAIDs can increase the risk of convulsions associated with quinolone antibiotics. Patients taking NSAIDs and quinolones may have an increased risk of developing convulsions.

NSAIDs given with zidovudine increase the risk of haematological toxicity. There is evidence of an increased risk of haemarthroses and haematoma in HIV (+) haemophiliacs receiving concurrent treatment with zidovudine and ibuprofen.

There is no evidence in animal or human studies that ketorolac tromethamine induces or inhibits the hepatic enzymes capable of metabolising itself or other drugs. Hence Ketorolac Tromethamine 30mg/ml solution for injection would not be expected to alter the pharmacokinetics of other drugs due to enzyme induction or inhibition mechanisms.

#### **4.6. Fertility, pregnancy and lactation**

In view of the known effects of NSAIDs on the foetal cardiovascular system (risk of closure of the ductus arteriosus) ketorolac is contra-indicated during pregnancy, labour or delivery

The safety of Ketorolac Tromethamine 30mg/ml solution for injection during human pregnancy has not been established. There was no evidence of teratogenicity in rats or rabbits studied at maternally-toxic doses of ketorolac. Prolongation of the gestation period and/or delayed parturition were seen in the rat. Congenital abnormalities have been reported in association with NSAID administration in man, however these are low in frequency and do not follow any discernible pattern.

Inhibition of prostaglandin synthesis may adversely affect the pregnancy and/or the embryo/foetal development. Data from epidemiological studies suggest an increased risk of miscarriage and of cardiac malformation and gastroschisis after use of a prostaglandin synthesis inhibitor in early pregnancy. The absolute risk for cardiovascular malformation was increased from less than 1%, up to approximately 1.5 %. The risk is believed to increase with dose and duration of therapy. In animals, administration of a prostaglandin synthesis inhibitor has been shown to result in increased pre- and post-implantation loss and embryo-foetal lethality. In addition, increased incidences of various malformations, including cardiovascular, have been reported in animals given a prostaglandin synthesis inhibitor during the organogenetic period.

During pregnancy, all prostaglandin synthesis inhibitors may expose the foetus to:

- cardiopulmonary toxicity (with premature closure of the ductus arteriosus and pulmonary hypertension);
- renal dysfunction, which may progress to renal failure with oligo-hydroamniosis;

the mother and the neonate, at the end of pregnancy, to:

- possible prolongation of bleeding time, an anti-aggregating effect which may occur even at very low doses.
- inhibition of uterine contractions resulting in delayed or prolonged labour.

See section 4.4 regarding female fertility.

Ketorolac crosses the placenta to the extent of approximately 10%.

#### ***Labour and Delivery:***

Ketorolac is contraindicated in labour and delivery because, through its prostaglandin synthesis inhibitory effect it may adversely affect foetal circulation and inhibit uterine contractions, thus increasing the risk of uterine haemorrhage.

There may be increased bleeding tendency in both mother and child (see section 4.3)

#### ***Nursing Mothers:***

Ketorolac and its metabolites have been shown to pass into the foetus and milk of animals. Ketorolac has been detected in human milk at low concentrations; therefore ketorolac is contra-indicated in mothers who are breast-feeding.

#### **4.7. Effects on ability to drive and use machines**

Some patients may experience dizziness, drowsiness, fatigue, visual disturbances, headaches, vertigo, insomnia or depression with the use of Ketorolac Tromethamine 30mg/ml solution for injection. If patients experience these, or other similar undesirable effects, patients should not drive or operate machinery.

#### **4.8. Undesirable effects**

##### **Post Marketing**

The following undesirable effects may occur in patients receiving Ketorolac IV; frequencies of reported events are not known, because they were reported voluntarily from a population of uncertain size.

**Gastro-intestinal disorders:** The most commonly observed adverse events are gastrointestinal in nature. Peptic ulcers, ulcers, perforation or GI bleeding, sometimes fatal, particularly in the elderly, may occur (see section 4.4). Nausea, vomiting diarrhoea, constipation, dyspepsia, abdominal pain / discomfort, melaena, haematemesis, stomatitis, ulcerative stomatitis, eructation, flatulence, oesophagitis, gastrointestinal ulceration, rectal bleeding, pancreatitis, dry mouth, fullness, exacerbation of colitis and Crohn's disease (see section 4.4) have been reported following administration. Less frequently, gastritis has been observed.

**Infection:** meningitis aseptic. (especially in patients with existing auto-immune disorders, such as systemic lupus erythematosus, mixed connective tissue disease), with symptoms such as stiff neck, headache, nausea, vomiting, fever or disorientation (see section 4.4)

**Blood and Lymphatic System Disorders:** thrombocytopenia  
Additionally purpura, neutropenia, agranulocytosis, aplastic anaemia and haemolytic anaemia have been observed.

**Immune System Disorders:** anaphylaxis, anaphylactoid reactions, anaphylactoid reactions like anaphylaxis, may have a fatal outcome, hypersensitivity reactions such as bronchospasm flushing, rash, hypotension, laryngeal oedema.

These may also occur in individuals with a history of angioedema, bronchospastic reactivity (e.g. asthma and nasal polyps).

**Metabolic and Nutrition Disorders:** anorexia, hyperkalaemia, hyponatraemia.

**Psychiatric Disorders:** abnormal thinking, depression, insomnia, anxiety, nervousness, psychotic reactions, abnormal dreams, hallucinations, euphoria, concentration ability impaired, drowsiness.

Confusion and stimulation have been observed.

**Nervous system disorders:** headache, dizziness, convulsions, paresthesia, hyperkinesias, taste abnormality.

**Eye Disorders:** abnormal vision, visual disturbances, optic neuritis.

**Ear Disorders:** tinnitus, hearing loss, vertigo.

**Renal and Urinary Disorders:** acute renal failure, increased urinary frequency, interstitial nephritis, nephrotic syndrome, urinary retention, oliguria, haemolytic uremic syndrome, flank pain(with or without haematuria +- azotemia). As with other drugs that inhibit renal prostaglandin synthesis signs of renal impairment, such as, but not limited to elevations of creatinine and potassium can occur after one dose of Ketorolac IV.

**Cardiac Disorders:** palpitations, bradycardia, cardiac failure.

**Vascular disorders:** hypertension, hypotension, haematoma, flushing, pallor, postoperative wound haemorrhage.

Clinical trial and epidemiological data suggest that use of coxibs and some NSAIDs (particularly at high doses) may be associated with a small increased risk of arterial thrombotic events (for example myocardial infarction or stroke). Although ketorolac has not shown to increase thrombotic events, such as myocardial infarction, there are insufficient data to exclude such a risk with ketorolac.

**Reproductive System and Breast Disorders:** female infertility.

**Respiratory, Thoracic and Mediastinal Disorders:** asthma, dyspnoea, pulmonary oedema. Additionally epistaxis has been observed.

**Hepatobiliary Disorders:** hepatitis, cholestatic jaundice, liver failure.

**Skin and Subcutaneous Tissue Disorders:** exfoliative dermatitis, maculopapular rash, pruritus, urticaria, purpura, angioedema, sweating, bullous reactions including Stevens-Johnson syndrome and toxic epidermal necrolysis (very rare).

Additionally erythema multiforme and skin photosensitivity has been observed.

**Musculoskeletal and Connective Tissue Disorders:** myalgia, functional disorder.

**General Disorders and Administration Site Condition:** excessive thirst, asthenia, oedema, injection site reactions and pain, fever, chest pain.

Additionally, malaise, fatigue and weight gain has been observed.

**Investigations:** bleeding time prolonged, serum urea increased, creatinine increased, abnormal liver function tests

#### **Laboratory Abnormalities**

See Section Post Marketing (Undesirable Effects).

#### **Reporting of suspected adverse reactions**

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via pharmacy and poisons board, Pharmacovigilance Electronic Reporting System (PvERS) <https://pv.pharmacyboardkenya.org>.

## **4.9. Overdose**

### **Symptoms and signs**

Single overdoses of Ketorolac have been variously associated with abdominal pain, nausea, vomiting, hyperventilation, peptic ulcers and/or erosive gastritis and renal dysfunction which have resolved after discontinuation of dosing.

Gastrointestinal bleeding may occur. Hypertension, acute renal failure, respiratory depression and coma may occur after the ingestion of NSAIDs but are rare.

Headache, epigastric pain, disorientation, excitation, drowsiness, dizziness, tinnitus and fainting have also been observed.

Rare cases of diarrhoea and occasional convulsions have been reported. Anaphylactoid reactions have been reported with therapeutic ingestion of NSAIDs and may occur following an overdose.

### **Treatment**

Patients should be managed by symptomatic and supportive care following NSAIDs overdose. There are no specific antidotes. Dialysis does not significantly clear ketorolac from the blood stream.

Within one hour of ingestion of a potentially toxic amount, activated charcoal should be considered. Alternatively, in adults, gastric lavage should be considered within one hour of ingestion of a potentially life-threatening overdose.

Good urine output should be ensured. Renal and liver function should be closely monitored. Patients should be observed for at least four hours after ingestion of potentially toxic amounts. Frequent or prolonged convulsions should be treated with intravenous diazepam. Other measures may be indicated by the patient's clinical condition.

## 5. Pharmacological properties

### 5.1. Pharmacodynamic properties

Pharmacotherapeutic group: Antiinflammatory and antirheumatic products, acetic acid derivatives and related substances ATC code M01AB15

Ketorolac is a potent analgesic agent of the non-steroidal, anti-inflammatory class (NSAID). It is not an opioid and has no known effects on opioid receptors. Its mode of action is to inhibit the cyclo-oxygenase enzyme system and hence prostaglandin synthesis, and it demonstrates a minimal anti-inflammatory effect at its analgesic dose.

### 5.2. Pharmacokinetic properties

*IM:* Following intramuscular administration, ketorolac tromethaminewas rapidly and completely absorbed, a mean peak plasma concentration of 2.2 $\mu$ g/ml occurring an average of 50 minutes after a single 30mg dose. The influences of age, kidney and liver function on terminal plasma half-life and mean total clearance are outlined in the table below (estimated from a single 30mg IM dose of ketorolac).

Type of subjects	Total clearance (l/hr/kg) mean (range)	Terminal half-life (hrs) mean (range)
Normal subjects (n = 54)	0.023 (0.010 - 0.046)	5.3 (3.5 - 9.2)
Patients with hepatic dysfunction (n = 7)	0.029 (0.013 - 0.066)	5.4 (2.2 - 6.9)
Patients with renal impairment (n = 25) (serum creatinine 160 - 430 micromol/l)	0.016 (0.005 - 0.043)	10.3 (5.9 - 19.2)
Renal dialysis patients (n = 9)	0.016 (0.003 - 0.036)	13.6 (8.0 - 39.1)
Healthy elderly subjects (n = 13) (mean age 72)	0.019 (0.013 - 0.034)	7.0 (4.7 - 8.6)

*IV:* Intravenous administration of a single 10mg dose of ketorolac tromethamineresulted in a mean peak plasma concentration of 2.4 $\mu$ g/ml occurring an average of 5.4 minutes after dosing, with a terminal plasma elimination half-life of 5.1 hours, an average volume of distribution of 0.15 l/kg, and a total plasma clearance of 0.35ml/min/kg.

The pharmacokinetics of ketorolac in man following single or multiple doses are linear. Steady-state plasma levels are achieved after dosing every six hours for one day. No changes in clearance occurred with chronic dosing. The primary route of excretion of ketorolac and its metabolites is renal: 91.4% (mean) of a given dose being found in the urine and 6.1% (mean) in the faeces.

More than 99% of the ketorolac in plasma is protein-bound over a wide concentration range.

### **5.3. Preclinical safety data.**

An 18-month study in mice with oral doses of ketorolac tromethamine at 2mg/kg/day (0.9 times human systemic exposure at the recommended IM or IV dose of 30mg qid, based on area-under-the-plasma-concentration curve [AUC]), and a 24-month study in rats at 5mg/kg/day (0.5 times the human AUC), showed no evidence of tumourigenicity.

Ketorolac tromethamine was not mutagenic in the Ames test, unscheduled DNA synthesis and repair, and in forward mutation assays. Ketorolac tromethamine did not cause chromosome breakage in the in vivo mouse micronucleus assay. At 1590µg/ml and at higher concentrations, ketorolac tromethamine increased the incidence of chromosomal aberrations in Chinese hamster ovarian cells.

Impairment of fertility did not occur in male or female rats at oral doses of 9mg/kg (0.9 times the human AUC) and 16mg/kg (1.6 times the human AUC) of ketorolac trometamol, respectively.

## **6. Pharmaceutical particulars**

### **6.1. List of excipients**

Ethanol 96%

Sodium chloride

Hydrochloric acid (for pH adjustment)

Sodium hydroxide (for pH adjustment)

Water for injections

Nitrogen 99.9% (for sterilization)

### **6.2. Incompatibilities**

Ketorolac Tromethamine 30mg/ml solution for injection should not be mixed in a small volume (e.g. in a syringe) with morphine sulphate, pethidine hydrochloride, promethazine hydrochloride or hydroxyzine hydrochloride as precipitation of ketorolac will occur.

It is compatible with 0.9% normal saline, 5% dextrose, Ringer's and lactated Ringer's solution.

### **6.3. Shelf life**

**Unopened:** 24 Months

**After opening:** The product must be used immediately.

**After dilution:** Chemical and physical in-use stability has been demonstrated for 48 hours at 25° C.

From a microbiological point of view, unless the method of opening and dilution precludes the risk of microbial contamination, the product should be used immediately. If not used immediately, in-use storage times and conditions are the responsibility of the user.

### **6.4. Special precautions for storage**

Keep ampoules in the original package to protect from light. This medicinal product does not require any special storage conditions. Do not refrigerate or freeze. Do not use if particulate matter is present.

**6.5. Nature and contents of container**

Ketorolac Tromethamine solution for injection 30mg are available in clear single-dose glass ampoules type 1.

**6.6. Special precautions for disposal and other handling**

For intramuscular or bolus intravenous injection.

For single use only. Discard any unused contents.

Any unused product or waste material should be disposed of in accordance with local requirements.

**7. Marketing authorisation holder**

Martin Dow Marker Limited 7-Jail Road, Quetta  
Pakistan

**Manufacturing address.**

Martin dow marker limited  
07,jail road, quetta, pakistan

**8. Marketing authorisation number(s)**

H2024/CTD9799/22112

**9. Date of first authorisation/renewal of the authorisation**

16/02/2024.

**10. Date of revision of the text**

November 2024.