

# Summary of Product Characteristics

## 1 NAME OF THE MEDICINAL PRODUCT

MultiHance 529 mg/ml solution for injection in pre-filled syringe

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

1 ml of solution for injection contains: gadobenic acid 334 mg (0.5 mmol) as dimeglumine salt. [Gadobenate dimeglumine 529 mg = gadobenic acid 334 mg + meglumine 195 mg].

10 ml of solution for injection contain: gadobenic acid 3340 mg (5 mmol) as dimeglumine salt. [gadobenate dimeglumine 5290 mg = gadobenic acid 3340 mg + meglumine 1950 mg]

15 ml of solution for injection contain: gadobenic acid 5010 mg (7.5 mmol) as dimeglumine salt. [gadobenate dimeglumine 7935= gadobenic acid 5010 mg + meglumine 2925 mg]

20 ml of solution for injection contain: gadobenic acid 6680 mg (10 mmol) as dimeglumine salt. [gadobenate dimeglumine 10580 mg = gadobenic acid 6680 mg + meglumine 3900 mg]

For a full list of excipients, see Section 6.1’.

## 3 PHARMACEUTICAL FORM

Solution for injection in a pre-filled syringe.  
Clear, colourless to slightly yellow, aqueous solution.

Osmolality at 37°C: 1.97 osmol/kg  
Viscosity at 37°C: 5.3 mPa.s  
pH: 6.9-7.3

## 4 CLINICAL PARTICULARS

### 4.1 Therapeutic Indications

This medicinal product is for diagnostic use only.

MultiHance is a paramagnetic contrast agent for use in diagnostic magnetic resonance imaging (MRI) indicated for:

- MRI of the brain and spine in adults and children above the age of 2 years, where it improves the detection of lesions and provides diagnostic information additional to that obtained with unenhanced MRI (see section 5.1).
- MR imaging of the whole body in adults and children (above the age of 2 years) including head and neck region, thoracic space (including the heart and female breast), abdomen (pancreas and liver), abdomen (gastrointestinal tract), retroperitoneal space (kidney, adrenal glands), pelvis (prostate, bladder and uterus) and musculoskeletal system where it facilitates identification of abnormal structures or lesions and helps in differentiating normal from pathological tissues (see sections 4.2 and 5.1).
- Magnetic Resonance Angiography (MRA) for the assessment of stenoses, occlusions and collaterals in adults and children (above the age of 2 years).
- Specific applications in the heart include measurement of myocardial perfusion under pharmacological stress conditions and viability diagnostics ("delayed enhancement").

### 4.2 Posology and method of administration

Posology

Target organ	Recommended dose
Brain and spine	0.1 mmol/kg body weight

	(0.2 mL/kg of the 0.5 M solution)
Liver, kidneys, urinary tract , adrenal glands	0.05 mmol/kg body weight (0.1 mL/kg of the 0.5 M solution)
Magnetic resonance angiography	0.1 mmol/kg body weight (0.2 mL/kg of the 0.5 M solution)
Head and neck region, thoracic space (including the heart and female breast), abdomen (gastrointestinal tract including pancreas), pelvis (prostate, bladder and uterus) and musculoskeletal system	0.1 mmol/kg body weight (0.2 mL/kg of the 0.5 M solution)
Cardiac MRI <ul style="list-style-type: none"><li>Assessment of cardiac masses or myocardial viability</li><li>Assessment of myocardial perfusion</li></ul>	0.1 mmol/kg body weight, administered as a single bolus of 0.2 mL/kg of the 0.5 M solution.  Two separate injections of 0.05 mmol/kg body weight (each corresponding to 0.1 mL/kg of the 0.5 M solution) during rest and stress imaging.

If required, the injection can be repeated in the same section in subjects with normal kidney function.

Method of administration

MultiHance should be used immediately after opening and should not be diluted. Any unused product should be discarded and not be used for other MRI examinations.

To use the syringe, the threaded tip of the plunger rod clockwise should be screwed into the plunger and pushed forward a few millimetres to break any friction between the plunger and syringe barrel.

Whilst holding syringe erect (with the nozzle cap upwards), the nozzle cap should be removed aseptically from the tip of the syringe and either a sterile, disposable needle or 5/6 tubing with a compatible luer lock should be attached using a push-twist action.

While still holding the syringe erect, the plunger should be pushed forward until all the air is evacuated and the fluid either appears at the tip of the needle or the tubing is completely filled.

To minimise the potential risks of soft tissue extravasation of MultiHance, it is important to ensure that the i.v. needle or cannula is correctly inserted into a vein.

The injection should be completed following the usual aspiration procedure.

The product should be administered intravenously either as a bolus or slow injection (10 mL/min.), see table for post-contrast imaging acquisition.

The injection should be followed by a flush of sodium chloride 9 mg/ml (0.9%) solution for injection.

Post-contrast imaging acquisition:

<u>Liver</u>	<u>Dynamic imaging:</u>	<u>Immediately following bolus injection.</u>
	<u>Delayed imaging:</u>	between 40 and 120 minutes following the injection, depending on the individual imaging needs.
<u>Brain and Spine</u>	up to 60 minutes after the administration.	
<u>MRA</u>	immediately after the administration, with scan delay calculated on the basis of test bolus or automatic bolus detection technique.  If an automatic contrast detection pulse sequence is not used for bolus timing, then a test bolus injection ≤2 mL of the agent should be used to calculate the appropriate scan delay.	
<u>Breast</u>	A T1-weighted, gradient-echo sequence with a time resolution of 2 minutes or less should be	

	acquired before contrast injection and repeated several times over a period of 5 to 8 min after a rapid intravenous contrast bolus injection.
Other body areas	T1-weighted sequences to be acquired as either dynamic or static delayed imaging.

*Special Populations*

Impaired renal function

Use of MultiHance should be avoided in patients with severe renal impairment (GFR < 30 ml/min/1.73m<sup>2</sup>) and in patients in the perioperative liver transplantation period unless the diagnostic information is essential and not available with non-contrast enhanced MRI (see information on renal impairment in section 4.4).

If use of MultiHance cannot be avoided, the dose should not exceed 0.1 mmol/kg body weight when used for MR of the brain and spine, MR-angiography, breast MRI or whole body MRI and should not exceed 0.05 mmol/kg body weight when used for MR of the liver, kidneys, urinary tract, or adrenal glands. More than one dose should not be used during a scan except for MR cardiac perfusion imaging where two separate doses of 0.05mmol/kg body weight can be administered in the course of a single examination. Because of the lack of information on repeated administration, MultiHance injections should not be repeated unless the interval between injections is at least 7 days

Hepatic impairment

No dose adjustment is considered necessary in patients with impaired liver function because hepatic impairment had little effect on the pharmacokinetics of MultiHance.

Elderly (aged 65 years and above)

No dosage adjustment is considered necessary. Caution should be exercised in elderly patients (see section 4.4).

Paediatric population

No dosage adjustment is considered necessary.  
Use of MultiHance is not recommended in children less than 2 years of age.

**4.3 Contraindications**

MultiHance is contra-indicated in:

- patients with hypersensitivity to the active substance or to any of the excipients listed in section 6.1 .
- patients with a history of allergic or adverse reactions to other gadolinium chelates.

**4.4 Special warnings and precautions for use**

The use of diagnostic contrast media, such as MultiHance, should be restricted to hospitals or clinics staffed for intensive care emergencies and where cardiopulmonary resuscitation equipment is readily available.

Patients should be kept under close supervision for 15 minutes following the injection as the majority of severe reactions occur at this time. The patient should remain in the hospital environment for one hour after the time of injection.

The accepted general safety procedures for Magnetic Resonance Imaging, in particular the exclusion of ferromagnetic objects, for example cardiac pace-makers or aneurysm clips, are also applicable when MultiHance is used.

Caution is advised in patients with cardiovascular disease.

In patients suffering from epilepsy or brain lesions the likelihood of convulsions during the examination may be increased. Precautions are necessary when examining these patients (e.g. monitoring of the patient) and the equipment and medicinal products needed for the rapid treatment of possible convulsions should be available.

*Hypersensitivity reactions*

As with other gadolinium chelates, the possibility of a reaction, including serious, life-threatening, or fatal anaphylactic and anaphylactoid reactions involving one or more body systems, mostly respiratory, cardiovascular and/or

mucocutaneous systems, should always be considered, especially in patients with a history of asthma or other allergic disorders.

Prior to MultiHance administration, ensure the availability of trained personnel and medications to treat hypersensitivity reactions.

Insignificant quantities of benzyl alcohol (<0.2%) may be released by gadobenate dimeglumine during storage. Nonetheless, MultiHance should not be used in patients with a history of sensitivity to benzyl alcohol. As with other gadolinium-chelates, a contrast-enhanced MRI should not be performed within 7 hours of a MultiHance-enhanced MRI examination to allow for clearance of MultiHance from the body.

Exercise caution to avoid local extravasation during intravenous administration of MultiHance. If extravasation occurs, evaluate and treat as necessary if local reactions develop (see section 4.8 Undesirable Effects).

#### *Impaired renal function*

**Prior to administration of MultiHance, it is recommended that all patients are screened for renal dysfunction by obtaining laboratory tests.**

There have been reports of nephrogenic systemic fibrosis (NSF) associated with use of some gadolinium containing contrast agents in patients with acute or chronic severe renal impairment ( $\text{GFR} < 30 \text{ ml/min/1.73m}^2$ ). Patients undergoing liver transplantation are at particular risk since the incidence of acute renal failure is high in this group. As there is a possibility that NSF may occur with MultiHance, it should therefore be avoided in patients with severe renal impairment and in patients in the perioperative liver transplantation period unless the diagnostic information is essential and not available with non-contrast enhanced MRI.

Haemodialysis shortly after MultiHance administration may be useful at removing MultiHance from the body. There is no evidence to support the initiation of haemodialysis for prevention or treatment of NSF in patients not already undergoing haemodialysis.

#### *Elderly*

As the renal clearance of gadobenate dimeglumine may be impaired in the elderly, it is particularly important to screen patients aged 65 years and older for renal dysfunction.

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

No interaction studies have been performed during the clinical development of MultiHance. However no drug interactions were reported during the clinical development programme.

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

#### **Pregnancy**

There are no data from the use of gadobenate dimeglumine in pregnant women. Animal studies have shown reproductive toxicity at repeated high doses (see section 5.3). MultiHance should not be used during pregnancy unless the clinical condition of the woman requires use of gadobenate dimeglumine.

#### **Lactation**

Gadolinium containing contrast agents are excreted into breast milk in very small amounts (see section 5.3). At clinical doses, no effects on the infant are anticipated due to the small amount excreted into milk and poor absorption from the gut. Continuing or discontinuing breast feeding for a period of 24 hours after administration of MultiHance should be at the discretion of the doctor and lactating mother.

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

MultiHance has no or negligible influence on the ability to drive and use machines.

4.8 Undesirable effects

The following adverse events were seen during the clinical development of MultiHance.

System organ classes	Clinical trials			Post-marketing surveillance
	Common (≥1/100, <1/10)	Uncommon (≥1/1,000, <1/100)	Rare (1/10,000, <1/1,000)	Frequency unknown**
Immune system disorders			Anaphylactic /anaphylactoid reaction, Hypersensitivity reaction	Anaphylactic shock
Nervous system disorders	Headache	Paraesthesia, Hypoaesthesia, Dizziness, Taste perversion	Convulsion, Syncope, Tremor, Parosmia	Loss of consciousness
Eye disorders			Visual disturbance	Conjunctivitis
Cardiac disorders		First-degree atrioventricular block, Tachycardia	Myocardial ischaemia, Bradycardia	Cardiac arrest, Cyanosis
Vascular disorders		Hypertension, Hypotension Flushing		
Respiratory, thoracic and mediastinal disorders			Dyspnoea Laryngospasm, Wheezing, Rhinitis, Cough	Respiratory failure, Laryngeal oedema, Hypoxia, Bronchospasm, Pulmonary oedema
Gastrointestinal disorders	Nausea	Diarrhoea, Vomiting, Abdominal pain	Faecal incontinence, Salivary hypersecretion, Dry mouth	Oedema mouth
Skin & subcutaneous tissue disorders		Urticaria, Rash including erythematous rash, macular, maculo-papular and papular rash, Pruritus, Sweating increased	Face oedema	Angioedema
Musculoskeletal, connective tissue and bone disorders			Myalgia	
Renal and urinary disorders		Proteinuria		
General disorders and administration site conditions	Injection Site Reaction including injection site pain, inflammation, burning, warmth, coldness,	Chest pain, , Pyrexia,Feeling hot	Asthenia, Malaise, Chills	Injection site swelling

	discomfort, erythema, paraesthesia and pruritus,			
Investigations		Electrocardiogram abnormalities*, Blood bilirubin increased, Blood iron increased, Increases in serum transaminases, gamma- glutamyl- transferase, lactic dehydrogenase and creatinine	Blood albumin decreased, Alkaline phosphatase increased	

\* Electrocardiogram abnormalities include electrocardiogram QT prolonged, electrocardiogram QT shortened, electrocardiogram T wave inversion, electrocardiogram PR prolongation, electrocardiogram QRS complex prolonged.

\*\* Since the reactions were not observed during clinical trials with 4,956 subjects, best estimate is that their relative occurrence is rare ( $\geq 1/10,000$  to  $<1/1000$ ).

The most appropriate MedDRA (version 16.1) term is used to describe a certain reaction and its symptoms and related conditions

Laboratory findings were mostly seen in patients with evidence of pre-existing impairment of hepatic function or pre-existing metabolic disease.

The majority of these events were non-serious, transient and spontaneously resolved without residual effects. There was no evidence of any correlation with age, gender or dose administered.

As with other gadolinium-chelates, there were reports of anaphylactic/ anaphylactoid/ hypersensitivity reactions. These reactions manifested with various degrees of severity up to anaphylactic shock and death, and involved one or more body system, mostly respiratory, cardiovascular, and/or mucocutaneous systems.

In patients with history ofconvulsion, brain tumours or metastasis, or other cerebral disorders, convulsions have been reported after MultiHance administration (see 4.4 Special warnings and precautions for use).

Injection site reactions due to extravasation of the contrast medium leading to local pain or burning sensations, swelling, blistering and, in rare cases when localised swelling is severe, necrosis have been reported. Localised thrombophlebitis has also been rarely reported (see section 4.4 Special warnings and precautions for use).

Isolated cases of nephrogenic systemic fibrosis (NSF) have been reported with MultiHance in patients co-administered other gadolinium-containing contrast agents (see Section 4.4).

Paediatric population

System Organ Class	Adverse Reactions	
	Clinical Trials	
	Common ( $\geq 1/100$ to $<1/10$ )	Uncommon ( $\geq 1/1000$ to $<1/100$ )
Nervous system disorders		Dizziness
Eye disorders		Eye pain, Eyelid oedema
Vascular disorders		Flushing
Gastrointestinal	Vomiting	Abdominal pain

disorders		
Skin and subcutaneous tissue disorders		Rash, Sweating increased
General disorders and administration site conditions		Chest pain, Injection site pain, Pyrexia

The adverse reactions reported among paediatric patients treated with MultiHance during clinical trials and tabulated above were non-serious. The adverse reactions identified during post-marketing surveillance indicate that MultiHance safety profile is similar in children and adults.

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 HPRA Pharmacovigilance, Earlsfort Terrace, IRL - Dublin 2; Tel: +353 1 6764971; Fax: +353 1 6762517. Website: [www.hpra.ie](http://www.hpra.ie); E-mail: [medsafety@hpra.ie](mailto:medsafety@hpra.ie).

**4.9 Overdose**

There have been no cases of overdose reported. Therefore, the signs and symptoms of overdosage have not been characterised. Doses up to 0.4 mmol/kg were administered to healthy volunteers, without any serious adverse events. However, doses exceeding the specific approved dosage are not recommended. In the event of overdosage, the patient should be carefully monitored and treated symptomatically.

MultiHance can be removed by haemodialysis. However there is no evidence that haemodialysis is suitable for prevention of nephrogenic systemic fibrosis (NSF) dialysable.

**5 PHARMACOLOGICAL PROPERTIES**

**5.1 Pharmacodynamic properties**

Pharmacotherapeutic group: paramagnetic contrast media ATC code V08CA08

Mechanism of action and pharmacodynamic effects

The gadolinium chelate, gadobenate dimeglumine, shortens longitudinal (T1), and transversal (T2) relaxation times of tissue water protons.

The relaxivities of gadobenate dimeglumine in aqueous solution are  $r_1 = 4.39$  and  $r_2 = 5.56 \text{ mM}^{-1}\text{s}^{-1}$  at 20 MHz. Gadobenate dimeglumine experiences a strong increase in relaxivity on going from aqueous solution to solutions containing serum proteins,  $r_1$  and  $r_2$  values were 9.7 and 12.5 respectively in human plasma.

Clinical efficacy and safety

In liver imaging, MultiHance may detect lesions not visualised in pre-contrast enhanced MRI examination of patients with known or suspected hepatocellular cancer or metastatic disease. The nature of the lesions visualised after contrast enhancement with MultiHance has not been verified by pathological anatomical investigation. Furthermore, where the effect on patient management was assessed, the visualisation of post-contrast-enhanced lesions was not always associated with a change in the patient management. In the liver MultiHance provides strong and persistent signal intensity enhancement of normal parenchyma on T1-weighted imaging. The signal intensity enhancement persists at high level for at least two hours after the administration of doses of either 0.05 or 0.10 mmol/kg. Contrast between focal liver lesions and normal parenchyma is observed almost immediately after bolus injection (up to 2-3 minutes) on T1-weighted dynamic imaging. Contrast tends to decrease at later time points because of non-specific lesion enhancement. However, progressive washout of MultiHance from the lesions and persistent signal intensity enhancement of normal parenchyma are considered to result in enhanced lesion detection and a lower detection threshold for lesion site between 40 and 120 minutes after MultiHance

administration.

Data from pivotal Phase II and Phase III studies in patients with liver cancer indicate that, compared with other reference imaging modalities (e.g. intraoperative ultrasonography, computed tomographic angio-portography, CTAP, or computed tomography following intra-arterial injection of iodized oil), with MultiHance enhanced MRI scans there was a mean sensitivity of 95% and a mean specificity of 80% for detection of liver cancer or metastasis in patients with a high suspicion of these conditions.

In MRI of the brain and spine, MultiHance enhances normal tissues lacking a blood-brain barrier, extra axial tumours and regions in which the blood-brain-barrier has broken down. In the pivotal phase III clinical trials conducted in adults for this indication, designed as parallel-group comparisons, off-site readers reported an improvement in level of diagnostic information in 32-69% of images with MultiHance, and 35-69% of images with the active comparator.

In two studies designed as intra-individual, crossover comparisons of 0.1 mmol/kg body weight MultiHance vs 0.1 mmol/kg body weight of two active comparators (gadopentetate dimeglumine or gadodiamide), conducted in patients with known or suspected brain or spine disease undergoing MRI of the central nervous system (CNS), MultiHance provided significantly (p<0.001) higher increase in lesion signal intensity, contrast-to-noise ratio, and lesion-to-brain ratio, as well as significantly (p<0.001) better visualisation of CNS lesions in images obtained with 1.5 Tesla scanners as tabulated below.

Visualisation of CNS Lesions Endpoints	Improvement Provided by MultiHance Over gadopentetate dimeglumine (Study MH-109) (n=151)	p-value	Improvement Provided by MultiHance Over gadodiamide (Study MH-130) (n=113)	p-value
Definition of extent of CNS Disease	25% to 30%	<0.001	24% to 25%	<0.001
Visualisation of Lesion Internal Morphology	29% to 34%	<0.001	28% to 32%	<0.001
Delineation of Borders of Intra- and Extra-axial Lesions	37% to 44%	<0.001	35% to 44%	<0.001
Lesion Contrast Enhancement	50% to 66%	<0.001	58% to 67%	<0.001
Global Diagnostic Preference	50% to 68%	<0.001	56% to 68%	<0.001

In the trials MH-109 and MH-130, the impact of improved visualization of CNS lesions with MultiHance versus gadodiamide or gadopentetate dimeglumine on diagnostic thinking and patient management was not studied.

In MRA, MultiHance improves image quality by increasing blood signal to noise ratio as a result of blood T1 shortening, reduces motion artifacts by shortening scan times and eliminates flow artifacts. In the phase III clinical trials in MRA of arteries extending from the supra-aortic territory to the pedal circulation, off-site readers reported an improvement in diagnostic accuracy ranging from 8% to 28% for the detection of clinically significant steno-occlusive disease (i.e. stenosis of >51% or >60% depending on the vascular territory) with MultiHance-enhanced images compared to time of flight (TOF) MRA, on the basis of conventional angiographic findings.

In MRI of female breast, MultiHance increases the contrast between neoplastic breast tissues and adjacent normal tissues, thus improving the conspicuity of breast tumors .

The pivotal, Phase III trial was an intra-individual, crossover comparison of 0.1 mmol/kg body weight MultiHance vs 0.1 mmol/kg body weight of an active, established comparator agent (gadopentate dimeglumine) in MRI of patients with suspected or known breast cancer on the basis of previous ultrasound or mammography. The images were read off-site by three blinded readers with no affiliation to any of the study centres.

The sensitivity for the detection of benign and malignant lesions ranged from 91.7%-94.4% for MultiHance and 79.9%



to 83.3% for the comparator ( $p < 0.0003$  for all readers).

The results for specificity in the detection of benign and malignant lesions were not statistically significant and ranged from 59.7%-66.7% for MultiHance and 30.6%-58.3% for the comparator ( $p < 0.157$  for all readers).

Statistically significant improvements were observed for both sensitivity and specificity in the region level analysis.

In MRI of the whole body, MultiHance provides contrast enhancement which helps in the identification of abnormal structures or lesions, and in differentiating normal from pathological tissues. Clinical trials have assessed the diagnostic performance (sensitivity, specificity, predictive values) of contrast-enhanced MRI with MultiHance in the detection or characterization of lesions in the kidneys or urinary tract, the adrenal glands, the heart, the gastro-intestinal tract, the pancreas, and the prostate.

In MRI of the kidney and urinary tract, 3 studies included evaluation of diagnostic performance of contrast-enhanced MRI with 0.05 mmol/kg MultiHance using standards of truth. Sensitivity and specificity values ranged from 75%-97.5% and 63.7%-100%, respectively.

In MRI of the adrenal glands, 2 studies of contrast-enhanced MRI with 0.05 mmol/kg MultiHance showed sensitivity ranging from 81 to 94.5%, and specificity from 93% to 100% for the distinction between benign and malignant lesions.

In cardiac MRI, 5 studies evaluated myocardial perfusion during rest and stress against a standard of truth for detecting ischaemic areas/perfusion defects or reduced coronary flow reserve. The administration of two 0.05 mmol/kg doses during rest and stress imaging provided sensitivity values ranging from 81% to 94.9% and specificity values between 75% and 100%. A study aimed at assessing the diagnostic performance of contrast enhanced MRI with 0.1 mmol/kg MultiHance for the characterization of neoplasms showed an accuracy value of 95% and excluded or reclassified masses in 44% of patients.

In MRI of the gastrointestinal tract, studies performed with MultiHance showed sensitivities of 85% and 96%, and specificities of 97% and 100% for the detection and evaluation of bowel endometriosis and the evaluation of acute appendicitis, respectively. Areas under the ROC curves of 0.784 (for perianal disease activity) and 0.875 (for fistula drainage assessment) were obtained by using contrast-enhanced MRI of the bowel with 0.1 mmol/kg dose of MultiHance in patients with Crohn's disease. The sensitivity and specificity of MRI with 0.1 mmol/kg MultiHance for local staging of rectal cancer were 86%-90.2% and 84.3%-85.3%, respectively.

In MRI of the pancreas, contrast-enhanced MRI with 0.1 mmol/kg MultiHance showed sensitivities between 84.6% and 100%, and specificities between 87% and 97%, for the detection of pancreatic cancer. A meta-analysis of 5 studies aimed at assessing the diagnostic performance of MultiHance-enhanced MRI in the detection of pancreatic cancer, using pathology as the standard of truth, showed pooled sensitivity and specificity values of 94.7% and 95.5%, respectively.

In MRI of the prostate, using pathology as the standard of truth, MultiHance-enhanced MRI showed sensitivity values ranging between 67% and 97.6%, and specificity values ranging from 65% to 100% for the detection of prostate cancer. A meta-analysis of 3 studies with pathology results as the reference standard, MultiHance enhanced MRI had a pooled sensitivity of 83.6%, and a specificity of 88.0% in the detection of prostate cancer lesions.

In MRI of the head and neck, a single study determined the diagnostic efficacy of time intensity curve analysis on DCE MRI using MultiHance for differentiation of benign from malignant head and neck tumours. In this study the sensitivity and specificity ranged from 75-83.3% and 80 to 100% respectively.

## 5.2 Pharmacokinetic properties

Modelling of the human pharmacokinetics was well described using a biexponential decay model. The apparent distribution and elimination half-times range from 0.085 to 0.117 h and from 1.17 to 1.68 respectively. The apparent total volume of distribution, ranging from 0.170 to 0.248 L/kg body weight, indicates that the compound is distributed in plasma and in the extracellular space.

Gadobenate ion is rapidly cleared from plasma and is eliminated mainly in urine and to a lesser extent in bile. Total plasma clearance, ranging from 0.098 to 0.133 L/h kg body weight, and renal clearance, ranging from 0.082 to 0.104 L/h kg body weight, indicate that the compound is predominantly eliminated by glomerular filtration. Plasma concentration and area under the curve (AUC) values show statistically significant linear dependence on the

administered dose. Gadobenate ion is excreted unchanged in urine in amounts corresponding to 78%-94% of the injected dose within 24 hours. Between 2% and 4% of the dose is recovered in the faeces.

Disruption of the blood-brain barrier or abnormal vascularity allows gadobenate ion penetration into the lesion.

Population pharmacokinetic analysis was performed on systemic drug concentration-time data from 80 subjects (40 adult healthy volunteers and 40 paediatric patients) aged 2 to 47 years following intravenous administration of gadobenate dimeglumine. The kinetics of gadolinium down to the age of 2 years could be described by a two compartment model with standard allometric coefficients and a covariate effect of creatinine clearance (reflecting glomerular filtration rate) on gadolinium clearance. The pharmacokinetic parameter values (referenced to adult body weight) were consistent with previously reported values for MultiHance and consistent with the physiology presumed to underlie MultiHance distribution and elimination: distribution into extracellular fluid (approximately 15 L in an adult, or 0.21 L/kg) and elimination by glomerular filtration (approximately 130 mL plasma per minute in an adult, or 7.8 L/h and 0.11 L/h/kg). Clearance and volume of distribution decreased progressively for younger subjects due to their smaller body size. This effect could largely be accounted for by normalising pharmacokinetic parameters for body weight. Based on this analysis, weight based dosing for MultiHance in paediatric patients gives similar systemic exposure (AUC) and maximum concentration (C<sub>max</sub>) to those reported for adults, and confirms that no dose adjustment is necessary for the paediatric population over the proposed age range (2 years and above).

### 5.3 Preclinical safety data

Non-clinical data reveal no special hazard for humans based on conventional studies of safety pharmacology, repeated dose toxicity, genotoxicity, carcinogenic potential.

Indeed, preclinical effects were observed only at exposures considered sufficiently in excess of the maximum human exposure indicating little relevance to clinical use.

Animal experiments revealed a poor local tolerance of MultiHance, especially in case of accidental paravenous application where severe local reaction, such as necrosis and eschars, could be observed.

Local tolerance in case of accidental intra-arterial application has not been investigated, so that it is particularly important to ensure that the i.v. needle or cannula is correctly inserted into a vein (see section 4.2).

#### Pregnancy and lactation

In animal studies no untoward effects on the embryonic or foetal development were exerted by daily intravenous administration of gadobenate dimeglumine in rats. Also, no adverse effects on physical and behavioural development were observed in the offspring of rats. However, after repeated daily dosing in rabbit, isolated cases of skeletal variations and two cases of visceral malformations were reported.

## 6 PHARMACEUTICAL PARTICULARS

### 6.1 List of excipients

Water for injections.

### 6.2 Incompatibilities

In the absence of compatibility studies, this medicinal product must not be mixed with other medicinal products.

### 6.3 Shelf life

3 years

From a microbiological point of view, the product should be used immediately after opening.

### 6.4 Special precautions for storage

Do not freeze.

## 6.5 Nature and contents of container

- 10, 15 and 20 mL solution filled into a single dose transparent plastic (cyclic polyolefin) syringe with chlorobutyl rubber plunger and tip cap.
- Kit with administration devices : 15 and 20 mL pre-filled syringe, 20 mL syringe (polypropylene), connector with 3-way stopcock (polycarbonate), spike (ABS/polypropylene), 20 G secured catheter.
- Kit with administration devices : 15 and 20 mL pre-filled syringe, syringe for magnetic resonance automatic injector ((115 mL syringe (polyethelene terephthalate/polycarbonate), connector (PVC/polycarbonate/polypropylene/silicone), spike (ABS))), 20 G secured catheter.

Not all pack sizes may be marketed.

## 6.6 Special precautions for disposal

For single use only.

Before use, examine the product to assure that the container and closure have not been damaged, the solution is not discoloured and no particulate matter is present.

The peel-off tracking label on the syringes should be stuck onto the patient records to enable accurate recording of the gadolinium contrast agent used. The dose used should also be recorded. If electronic patient records are used, the name of the product, the batch number and the dose should be entered into the patient record.

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

## 7 MARKETING AUTHORISATION HOLDER

Bracco Imaging SpA  
via Egidio Folli 50  
20134 Milan  
Italy

## 8 MARKETING AUTHORISATION NUMBER

PA1826/001/002

## 9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of First Authorisation: 4<sup>th</sup> July 2008

Date of last renewal: 21<sup>st</sup> July 2012

## 10 DATE OF REVISION OF THE TEXT

January 2017