

NDA 19-596-S-045/21-037/S-019

Page 3

MAGNEVIST®
(brand of gadopentetate dimeglumine)

Injection

6703001

FOR INTRAVENOUS ADMINISTRATION

Rx only

WARNING: NEPHROGENIC SYSTEMIC FIBROSIS

Gadolinium-based contrast agents increase the risk for nephrogenic systemic fibrosis (NSF) in patients with:

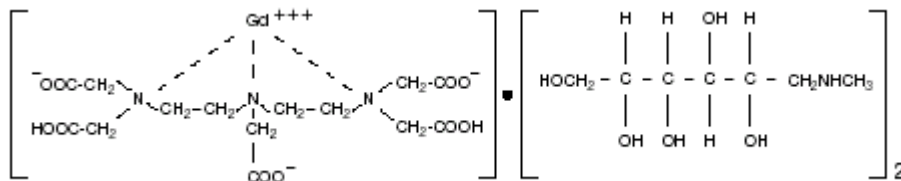
- Acute or chronic severe renal insufficiency (glomerular filtration rate < 30 mL/min/1.73m²), or
- Acute renal insufficiency of any severity due to the hepato-renal syndrome or in the perioperative liver transplantation period.

In these patients, avoid use of gadolinium-based contrast agents unless the diagnostic information is essential and not available with non-contrast enhanced magnetic resonance imaging (MRI). NSF may result in fatal or debilitating systemic fibrosis affecting the skin, muscle and internal organs. Screen all patients for renal dysfunction by obtaining a history and/or laboratory tests. When administering a gadolinium-based contrast agent, do not exceed the recommended dose and allow a sufficient period of time for elimination of the agent from the body prior to any readministration (See **WARNINGS**).

DESCRIPTION

MAGNEVIST® (brand of gadopentetate dimeglumine) Injection is the N- methylglucamine salt of the gadolinium complex of diethylenetriamine pentaacetic acid, and is an injectable contrast medium for magnetic resonance imaging (MRI). MAGNEVIST Injection is provided as a sterile, clear, colorless to slightly yellow aqueous solution for intravenous injection.

MAGNEVIST Injection is a 0.5-mol/L solution of 1-deoxy-1-(methylamino)-D-glucitol dihydrogen [N,N-bis[2-[bis(carboxymethyl)amino]ethyl]-glycinato-(5'-)]gadolate(2-):(2:1) with a molecular weight of 938, an empirical formula of C₂₈H₅₄GdN₅O₂₀, and has the following structural formula:



Each mL of MAGNEVIST Injection contains 469.01 mg gadopentetate dimeglumine, 0.99 mg meglumine, 0.40 mg diethylenetriamine pentaacetic acid and water for injection. MAGNEVIST Injection contains no antimicrobial preservative.

MAGNEVIST Injection has a pH of 6.5 to 8.0. Pertinent physicochemical data are noted below:
PARAMETER Osmolality (mOsmol/ kg water) at 37° C 1,960 Viscosity (CP) at 20° C 4.9 at 37° C 2.9
Density (g/mL) at 25° C 1.195 Specific gravity at 25° C 1.208 Octanol: H₂O at 25° C and pH7 log P_{ow}
= - 5.4

NDA 19-596-S-045/21-037/S-019

Page 4

MAGNEVIST Injection has an osmolality 6.9 times that of plasma which has an osmolality of 285 mOsmol/kg water. MAGNEVIST Injection is hypertonic under conditions of use.

CLINICAL PHARMACOLOGY

Pharmacokinetics

The pharmacokinetics of intravenously administered gadopentetate dimeglumine in normal subjects conforms to a two compartment open-model with mean distribution and elimination half-lives (reported as mean \pm SD) of about 0.2 ± 0.13 hours and 1.6 ± 0.13 hours, respectively.

Upon injection, the meglumine salt is completely dissociated from the gadopentetate dimeglumine complex. Gadopentetate is exclusively eliminated in the urine with $83 \pm 14\%$ (mean \pm SD) of the dose excreted within 6 hours and $91 \pm 13\%$ (mean \pm SD) by 24 hours, post-injection. There was no detectable biotransformation or decomposition of gadopentetate dimeglumine.

The renal and plasma clearance rates (1.76 ± 0.39 mL/min/kg and 1.94 ± 0.28 mL/min/kg, respectively) of gadopentetate are essentially identical, indicating no alteration in elimination kinetics on passage through the kidneys and that the drug is essentially cleared through the kidney. The volume of distribution (266 ± 43 mL/kg) is equal to that of extracellular water and clearance is similar to that of substances which are subject to glomerular filtration.

In vitro laboratory results indicate that gadopentetate does not bind to human plasma protein. *In vivo* protein binding studies have not been done.

Pharmacodynamics

Gadopentetate dimeglumine is a paramagnetic agent and, as such, it develops a magnetic moment when placed in a magnetic field. The relatively large magnetic moment produced by the paramagnetic agent results in a relatively large local magnetic field, which can enhance the relaxation rates of water protons in the vicinity of the paramagnetic agent.

In magnetic resonance imaging (MRI), visualization of normal and pathological brain tissue depends in part on variations in the radiofrequency signal intensity that occur with 1) changes in proton density; 2) alteration of the spin-lattice or longitudinal relaxation time (T1); and 3) variation of the spin-spin or transverse relaxation time (T2). When placed in a magnetic field, gadopentetate dimeglumine decreases the T1 and T2 relaxation time in tissues where it accumulates. At usual doses the effect is primarily on the T1 relaxation time.

Gadopentetate dimeglumine does not cross the intact blood-brain barrier and, therefore, does not accumulate in normal brain or in lesions that do not have an abnormal blood-brain barrier, e. g., cysts, mature post-operative scars, etc. However, disruption of the blood-brain barrier or abnormal vascularity allows accumulation of gadopentetate dimeglumine in lesions such as neoplasms, abscesses, and subacute infarcts. The pharmacokinetic parameters of MAGNEVIST in various lesions are not known.

CLINICAL TRIALS

NDA 19-596-S-045/21-037/S-019

Page 5

MAGNEVIST Injection was administered to 1272 patients in open label controlled clinical studies. The mean age of these patients was 46.4 years (range 2 to 93 years). Of these patients, 55% (700) were male and 45% (572) were female. Of the 1271 patients who received MAGNEVIST Injection and for whom race was reported, 82.1% (1043) were Caucasian, 9.7% (123) were Black, 5.3% (67) were Hispanic, 2.1% (27) were Oriental/ Asian, and 0.9% (11) were other. Of the 1272 patients, 550 patients were evaluated in blinded reader studies. These evaluated the use of contrast enhancement in magnetic resonance imaging of lesions in the head and neck, brain, spine and associated tissues, and body (excluding the heart). Of the 550 patients, all patients had a reason for an MRI and efficacy assessments were based on pre-and post- MAGNEVIST injection film quality, film contrast, lesion configuration (border, size, and location), and the number of lesions. The protocols did not include systematic verification of specific diseases or histopathologic confirmation of findings.

Of the above 550 patients, 97 patients received 0.1 mmol/kg MAGNEVIST Injection I. V. in two clinical trials of MAGNEVIST MRI contrast enhancement for body imaging. Of these 97, 68 had MRIs of the internal organs/ structures of the abdomen or thorax (excluding the heart); 8 had breast images and 22 had images of appendages. The results of MRIs before and after MAGNEVIST use were compared blindly. Overall additional lesions were identified in 22/ 97 (23%) of the patients after MAGNEVIST Injection. The mean number of lesions identified before (1.49/ patient) and after MAGNEVIST (1.75/ patient) were similar. Seven (8%) of the patients had lesions seen before MAGNEVIST that were not seen after MAGNEVIST. Overall, after MAGNEVIST Injection, 41% of the images had a higher contrast score than before injection; and 18% of the images had a higher contrast score before MAGNEVIST Injection than after MAGNEVIST Injection. MAGNEVIST MRI of the 8 patients with breast images were not systematically compared to the results to mammography, breast biopsy or other modalities. In the 22 patients with appendage images (e. g., muscle, bone and intraarticular structures), MAGNEVIST MRI was not systematically evaluated to determine the effects of contrast biodistribution in these different areas.

Of the above 550 patients, 66 patients received MAGNEVIST 0.1 mmol/ kg I. V. in clinical trials of MAGNEVIST MRI contrast enhancement of lesions in the head and neck. A total of 66 MRI images were evaluated blindly by comparing each pair of MRI images, before and after MAGNEVIST Injection. In these paired images, 56/66 (85%) had greater enhancement after MAGNEVIST and 40/66 (61%) had better lesion configuration or border delineation after MAGNEVIST. Overall, there was better contrast after MAGNEVIST in 55% of the images, comparable enhancement in 44 (36%) before and after MAGNEVIST, and better enhancement in 9% without MAGNEVIST.

In the studies of the brain and spinal cord, MAGNEVIST 0.1 mmol/kg I. V. provided contrast enhancement in lesions with an abnormal blood brain barrier.

In two studies, a total of 108 patients were evaluated to compare the dose response effects of 0.1 mmol/kg and 0.3 mmol/kg of MAGNEVIST in CNS MRI. Both dosing regimens had similar imaging and general safety profiles; however, the 0.3 mmol/kg dose did not provide additional benefit to the final diagnosis (defined as number of lesions, location and characterization).

INDICATIONS AND USAGE

Central Nervous System:

MAGNEVIST Injection is indicated for use with magnetic resonance imaging (MRI) in adults, and pediatric patients (2 years of age and older) to visualize lesions with abnormal vascularity in the brain

NDA 19-596-S-045/21-037/S-019

Page 6

(intracranial lesions), spine and associated tissues. MAGNEVIST Injection has been shown to facilitate visualization of intracranial lesions including but not limited to tumors.

Extracranial/ Extrapapinal Tissues:

MAGNEVIST is indicated for use with MRI in adults and pediatric patients (2 years of age and older) to facilitate the visualization of lesions with abnormal vascularity in the head and neck.

Body:

MAGNEVIST Injection is indicated for use in MRI in adults and pediatric patients (2 years of age and older) to facilitate the visualization of lesions with abnormal vascularity in the body (excluding the heart).

CONTRAINDICATIONS

None.

WARNINGS AND PRECAUTIONS

Nephrogenic Systemic Fibrosis (NSF)

Gadolinium-based contrast agents increase the risk for nephrogenic systemic fibrosis (NSF) in patients with acute or chronic severe renal insufficiency (glomerular filtration rate $< 30 \text{ mL/min/1.73 m}^2$) and in patients with acute renal insufficiency of any severity due to the hepato-renal syndrome or in the perioperative liver transplantation period. In these patients, avoid use of gadolinium-based contrast agents unless the diagnostic information is essential and not available with non-contrast enhanced MRI. For patients receiving hemodialysis, physicians may consider the prompt initiation of hemodialysis following the administration of a gadolinium-based contrast agent in order to enhance the contrast agent's elimination. The usefulness of hemodialysis in the prevention of NSF is unknown.

Among the factors that may increase the risk for NSF are repeated or higher than recommended doses of a gadolinium-based contrast agent and the degree of renal function impairment at the time of exposure.

Post-marketing reports have identified the development of NSF following single and multiple administrations of gadolinium-based contrast agents. These reports have not always identified a specific agent. Where a specific agent was identified, the most commonly reported agent was gadodiamide (OmniscanTM), followed by gadopentetate dimeglumine (Magnevist[®]) and gadoversetamide (OptiMARK[®]). NSF has also developed following sequential administrations of gadodiamide with gadobenate dimeglumine (MultiHance[®]) or gadoteridol (ProHance[®]). The number of post-marketing reports is subject to change over time and may not reflect the true proportion of cases associated with any specific gadolinium-based contrast agent.

The extent of risk for NSF following exposure to any specific gadolinium-based contrast agent is unknown and may vary among the agents. Published reports are limited and predominantly estimate NSF risks with gadodiamide. In one retrospective study of 370 patients with severe renal insufficiency who received gadodiamide, the estimated risk for development of NSF was 4% (J Am Soc Nephrol 2006; 17:2359). The risk, if any, for the development of NSF among patients with mild to moderate renal insufficiency or normal renal function is unknown.

Screen all patients for renal dysfunction by obtaining a history and/or laboratory tests. When administering a gadolinium-based contrast agent, do not exceed the recommended dose and allow a

NDA 19-596-S-045/21-037/S-019

Page 7

sufficient period of time for elimination of the agent prior to any readministration. (See **CLINICAL PHARMACOLOGY** and **DOSAGE AND ADMINISTRATION**).

Hypersensitivity reactions

Anaphylactoid and anaphylactic reactions with cardiovascular, respiratory and/or cutaneous manifestations rarely resulting in death have occurred. If such a reaction occurs, stop MAGNEVIST Injection and immediately begin appropriate therapy, including resuscitation.

Observe closely patients with a history of drug reactions, allergy or other hypersensitivity disorders, during and up to several hours after MAGNEVIST Injection.

Acute renal failure

In patients with renal insufficiency, acute renal failure requiring dialysis or worsening renal function have occurred, mostly within 48 hrs of MAGNEVIST Injection. The risk of these events is higher with increasing dose of contrast. Use the lowest possible dose and evaluate renal function in patients with renal insufficiency.

MAGNEVIST is cleared by glomerular filtration and is dialyzable.

Injection site reactions

Skin and soft tissue necrosis, thrombosis, fasciitis, and compartment syndrome requiring surgical intervention (e.g. compartment release or amputation) have occurred very rarely at the site of contrast injection or the dosed limb. Total volume and rate of MAGNEVIST Injection, extravasation of contrast agent, and patient susceptibility might contribute to these reactions. Phlebitis and thrombophlebitis may be observed generally within 24 hours after MAGNEVIST Injection and resolve with supportive treatment. Determine the patency and integrity of the intravenous line before administration of MAGNEVIST Injection. Assessment of the dosed limb for the development of injection site reactions is recommended.

Interference with Visualization of lesions visible with non-contrast MRI

As with any paramagnetic contrast agent, MAGNEVIST Injection might impair the visualization of lesions seen on non-contrast MRI. Therefore, caution should be exercised when MAGNEVIST MRI scans are interpreted without a companion non-contrast MRI scan.

Patient counseling information

Patients scheduled to receive MAGNEVIST Injection should be instructed to inform their physician if they are pregnant, breast feed, or have a history of renal insufficiency, asthma or allergic respiratory disorders.

LABORATORY TEST FINDINGS

Transitory changes in serum iron, bilirubin and transaminase levels were observed in clinical trials.

MAGNEVIST Injection does not interfere with serum and plasma calcium measurements determined by colorimetric assays.

CARCINOGENESIS, MUTAGENESIS AND IMPAIRMENT OF FERTILITY Long term animal studies have not been performed to evaluate the carcinogenic potential of gadopentetate dimeglumine.

NDA 19-596-S-045/21-037/S-019

Page 8

A comprehensive battery of *in vitro* and *in vivo* studies in bacterial and mammalian systems suggest that gadopentetate dimeglumine is not mutagenic or clastogenic and does not induce unscheduled DNA repair in rat hepatocytes or cause cellular transformation of mouse embryo fibroblasts. However, the drug did show some evidence of mutagenic potential *in vivo* in the mouse dominant lethal assay at doses of 6 mmol/kg, but did not show any such potential in the mouse and dog micronucleus tests at intravenous doses of 9 mmol/kg and 2.5 mmol/kg, respectively.

When administered intra-peritoneally to male and female rats daily prior to mating, during mating and during embryonic development for up to 74 days (males) or 35 days (females), gadopentetate caused a decrease in number of corpora lutea at the 0.1 mmol/kg dose level. After daily dosing with 2.5 mmol/kg suppression of food consumption and body weight gain (males and females) and a decrease in the weights of testes and epididymis were also observed.

In a separate experiment in rats, daily injections of gadopentetate dimeglumine over 16 days caused spermatogenic cell atrophy at a dose level of 5 mmol/kg but not at a dose level of 2.5 mmol/kg. This atrophy was not reversed within a 16-day observation period following the discontinuation of the drug.

PREGNANCY CATEGORY C.

Gadopentetate dimeglumine retarded fetal development slightly when given intravenously for 10 consecutive days to pregnant rats at daily doses of 0.25, 0.75, and 1.25 mmol/kg (2.5, 7.5 and 12.5 times the human dose based on body weight) and when given intravenously for 13 consecutive days to pregnant rabbits at daily doses of 0.75 and 1.25 mmol/kg (7.5 and 12.5 times the human dose respectively, based on body weight) but not at daily doses of 0.25 mmol/kg. No congenital anomalies were noted in rats or rabbits.

Adequate and well controlled studies were not conducted in pregnant women. MAGNEVIST Injection should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

NURSING WOMEN

MAGNEVIST is excreted in human milk. MAGNEVIST Injection was administered intravenously to 18 lactating women with normal renal function at a dose of 0.1 mmol/kg body weight. In these women, less than 0.04% of the administered gadolinium was excreted into the breast milk during the 24-hour period following dosing. Breast milk obtained during the 24 hours following dosing revealed the average cumulative amount of gadolinium excreted in breast milk was 0.57±0.71 micromol. The amount transferred from a 70 kg woman (receiving 0.1 mmol/kg body weight) to an infant by breast feeding over a period of 24 hrs translates into less than 3 micromol of gadolinium.

The overall duration of excretion of gadolinium into breast milk is unknown. The extent of the absorption of MAGNEVIST Injection in infants and its effect on the breast-fed child remains unknown. Caution should be exercised when MAGNEVIST Injection is administered to a nursing woman.

PEDIATRIC USE

The use of MAGNEVIST in imaging the Central Nervous System, Extracranial/ Extrapapillary tissues, and Body have been established in the pediatric population from the ages of 2 to 16 years on the basis of adequate and well controlled clinical trials in adults and safety studies in this pediatric population. (See **Clinical Trials** for details.)

NDA 19-596-S-045/21-037/S-019

Page 9

Safety and efficacy in the pediatric population under the age of 2 years have not been established. MAGNEVIST is eliminated primarily by the kidney. The pharmacokinetics of MAGNEVIST in neonates and infants with immature renal function have not been studied. (See **INDICATIONS** and **DOSAGE AND ADMINISTRATION**)

ADVERSE REACTIONS

The mean age of the 1272 patients who received MAGNEVIST Injection in clinical trials was 46.4 years (range 2 to 93 years). Of these patients, 55% (700) were male and 45% (572) were female. Of the 1271 patients who received MAGNEVIST Injection and for whom race was reported, 82.1% (1043) were Caucasian, 9.7% (123) were Black, 5.3% (67) were Hispanic, 2.1% (27) were Oriental/ Asian, and 0.9% (11) were other. The most common noted adverse event is headache with an incidence of 4.8%. The majority of headaches are transient and of mild to moderate severity. Nausea is the second most common adverse experience at 2.7%. Injection site coldness/localized coldness is the third most common adverse experience at 2.3%. Dizziness occurred in 1% of the patients.

The following additional adverse events occurred in fewer than 1% of the patients:

Body as a Whole: Injection site symptoms, namely, pain, localized warmth, and burning sensation; substernal chest pain, back pain, fever, weakness, generalized coldness, generalized warmth, localized edema, tiredness, chest tightness, trembling, shivering, tension in extremities, regional lymphangitis, pelvic pain, and anaphylactoid reactions (characterized by cardiovascular, respiratory and cutaneous symptoms) rarely resulting in death.

Cardiovascular: Hypotension, hypertension, arrhythmia, tachycardia, migraine, syncope, vasodilation, pallor, non-specific ECG changes, angina pectoris, death related to myocardial infarction or other undetermined causes, phlebitis, thrombophlebitis, deep vein thrombophlebitis, compartment syndrome requiring surgical intervention.

Digestive: Gastrointestinal distress, stomach pain, teeth pain, increased salivation, abdominal pain, vomiting, constipation, diarrhea.

Nervous System: Agitation, anxiety, thirst, anorexia, nystagmus, drowsiness, diplopia, stupor, convulsions (including grand mal), paresthesia.

Respiratory System: Throat irritation, rhinorrhea, sneezing, dyspnea, wheezing, laryngismus, cough, respiratory complaints.

Skin: Rash, sweating, pruritus, urticaria (hives), facial edema, erythema multiforme, epidermal necrolysis, pustules.

Special Senses: Tinnitus, conjunctivitis, visual field defect, taste abnormality, dry mouth, lacrimation disorder (tearing), eye irritation, eye pain, ear pain.

OVERDOSAGE

Systemic consequences associated with overdosage of MAGNEVIST Injection have not been reported.

DOSAGE AND ADMINISTRATION

NDA 19-596-S-045/21-037/S-019

Page 10

The recommended dosage of MAGNEVIST Injection is 0.2 mL/kg (0.1 mmol/ kg) administered intravenously, at a rate not to exceed 10 mL per 15 seconds. Dosing for patients in excess of 286 lbs has not been studied systematically.

DOSE AND DURATION OF MAGNEVIST INJECTION BY BODY WEIGHT		
BODY WEIGHT		Total Volume, mL*
lb	kg	
22	10	2
44	20	4
66	30	6
88	40	8
110	50	10
132	60	12
154	70	14
176	80	16
198	90	18
220	100	20
242	110	22
264	120	24
286	130	26

*Rate of Injection: 10 mL/15sec

Drug Handling: To ensure complete injection of the contrast medium, the injection should be followed by a 5-mL normal saline flush. The imaging procedure should be completed within 1 hour of injection of MAGNEVIST Injection.

As with other gadolinium contrast agents, MAGNEVIST Injection has not been established for use in magnetic resonance angiography.

Parenteral products should be inspected visually for particulate matter and discoloration prior to administration. Do not use the solution if it is discolored or particulate matter is present.

Any unused portion must be discarded in accordance with regulations dealing with the disposal of such materials.

HOW SUPPLIED

MAGNEVIST Injection is a clear, colorless to slightly yellow solution containing 469.01 mg/ mL of gadopentetate dimeglumine. MAGNEVIST Injection is supplied in the following sizes:

5 mL single- dose vials, rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 05

5 mL single- dose vials (RFID), rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 40

10 mL single- dose vials, rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 01

NDA 19-596-S-045/21-037/S-019

Page 11

10 mL single- dose vials (RFID), rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 42

10 mL pre- filled disposable syringe, Boxes of 5
NDC 50419- 188- 36

10 mL pre- filled disposable syringe (RFID), Boxes of 5
NDC 50419- 188- 43

15 mL single- dose vials, rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 15

15 mL single- dose vials (RFID), rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 44

15 mL pre- filled disposable syringe, Boxes of 5
NDC 50419- 188- 37

15 mL pre- filled disposable syringe (RFID), Boxes of 5
NDC 50419- 188-45

20 mL single- dose vials, rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 02

20 mL single- dose vials (RFID), rubber stoppered, in individual cartons, Boxes of 20
NDC 50419- 188- 46

20 mL pre- filled disposable syringe, Boxes of 5
NDC 50419- 188- 38

20 mL pre- filled disposable syringe (RFID), Boxes of 5
NDC 50419- 188- 47

STORAGE

MAGNEVIST Injection should be stored at controlled room temperature, between 15-30° C (59- 86° F) and protected from light. DO NOT FREEZE. Should freezing occur in the vial MAGNEVIST Injection should be brought to room temperature before use. If allowed to stand at room temperature for a minimum of 90 minutes, MAGNEVIST Injection should return to a clear, colorless to slightly yellow solution. Before use, examine the product to assure that all solids are redissolved and that the container and closure have not been damaged. Should solids persist, discard vial.

U. S. Patent Nos. 5,362,475; 5,560,903 and, 5,876,695 relate to this product

Manufactured for:



Bayer HealthCare
Pharmaceuticals

Bayer HealthCare Pharmaceuticals Inc.
Wayne, NJ 07470

NDA 19-596-S-045/21-037/S-019
Page 12

Manufactured in Germany

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Revised January 2008

NDA 19-596-S-045/21-037/S-019

Page 13

MAGNEVIST®
(brand of gadopentetate dimeglumine)
Injection

FOR INTRAVENOUS ADMINISTRATION

Pharmacy Bulk Package – Not For Direct Infusion

Rx only

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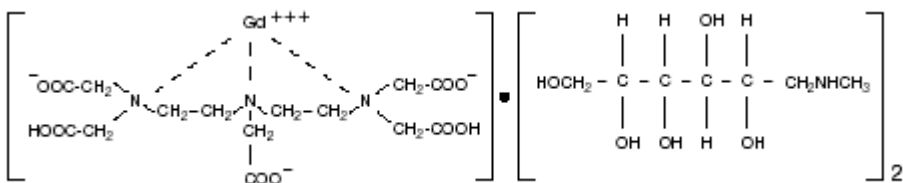
- Acute or chronic severe renal insufficiency (glomerular filtration rate < 30 mL/min/1.73m²), or
- Acute renal insufficiency of any severity due to the hepato-renal syndrome or in the perioperative liver transplantation period.

In these patients, avoid use of gadolinium-based contrast agents unless the diagnostic information is essential and not available with non-contrast enhanced magnetic resonance imaging (MRI). NSF may result in fatal or debilitating systemic fibrosis affecting the skin, muscle and internal organs. Screen all patients for renal dysfunction by obtaining a history and/or laboratory tests. When administering a gadolinium-based contrast agent, do not exceed the recommended dose and allow a sufficient period of time for elimination of the agent from the body prior to any readministration (See **WARNINGS**).

DESCRIPTION

MAGNEVIST® (brand of gadopentetate dimeglumine) Injection is the N- methylglucamine salt of the gadolinium complex of diethylenetriamine pentaacetic acid, and is an injectable contrast medium for magnetic resonance imaging (MRI). MAGNEVIST Injection is provided as a sterile, clear, colorless to slightly yellow aqueous solution for intravenous injection.

MAGNEVIST Injection is a 0.5- mol/L solution of 1-deoxy-1-(methylamino)-D-glucitol dihydrogen [N,N-bis[2-[bis(carboxymethyl)amino]ethyl]-glycinato-(5⁻)]gadolinato(2⁻) (2:1) with a molecular weight of 938, an empirical formula of C₂₈H₅₄GdN₅O₂₀, and has the following structural formula:



NDA 19-596-S-045/21-037/S-019

Page 14

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MAGNEVIST Injection has a pH of 6.5 to 8.0. Pertinent physicochemical data are noted below:

PARAMETER

Osmolality (mOsmol/kg water)

at 37° C 1,960

Viscosity (CP)

at 20° C 4.9

at 37° C 2.9

Density (g/mL)

at 25° C 1.195

Specific gravity

at 25° C 1.208

Octanol: H₂O

at 25° C

and pH7 log P_{ow} = - 5.4

MAGNEVIST Injection has an osmolality 6.9 times that of plasma which has an osmolality of 285 mOsmol/kg water. MAGNEVIST Injection is hypertonic under conditions of use.

CLINICAL PHARMACOLOGY

Pharmacokinetics

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Upon injection, the meglumine salt is completely dissociated from the gadopentetate dimeglumine complex. Gadopentetate is exclusively eliminated in the urine with 83 ± 14% (mean ± SD) of the dose excreted within 6 hours and 91 ± 13% (mean ± SD) by 24 hours, post-injection. There was no detectable biotransformation or decomposition of gadopentetate dimeglumine.

The renal and plasma clearance rates (1.76 ± 0.39 mL/min/kg and 1.94 ± 0.28 mL/min/kg, respectively) of gadopentetate are essentially identical, indicating no alteration in elimination kinetics on passage through the kidneys and that the drug is essentially cleared through the kidney. The volume of distribution (266 ± 43 mL/kg) is equal to that of extracellular water and clearance is similar to that of substances which are subject to glomerular filtration.

NDA 19-596-S-045/21-037/S-019

Page 15

In vitro laboratory results indicate that gadopentetate does not bind to human plasma protein. *In vivo* protein binding studies have not been done.

Pharmacodynamics

Gadopentetate dimeglumine is a paramagnetic agent and, as such, it develops a magnetic moment when placed in a magnetic field. The relatively large magnetic moment produced by the paramagnetic agent results in a relatively large local magnetic field, which can enhance the relaxation rates of water protons in the vicinity of the paramagnetic agent.

In magnetic resonance imaging (MRI), visualization of normal and pathological brain tissue depends in part on variations in the radiofrequency signal intensity that occur with 1) changes in proton density; 2) alteration of the spin-lattice or longitudinal relaxation time (T1); and 3) variation of the spin-spin or transverse relaxation time (T2). When placed in a magnetic field, gadopentetate dimeglumine decreases the T1 and T2 relaxation time in tissues where it accumulates. At usual doses the effect is primarily on the T1 relaxation time.

Gadopentetate dimeglumine does not cross the intact blood-brain barrier and, therefore, does not accumulate in normal brain or in lesions that do not have an abnormal blood-brain barrier, e. g., cysts, mature post-operative scars, etc. However, disruption of the blood-brain barrier or abnormal vascularity allows accumulation of gadopentetate dimeglumine in lesions such as neoplasms, abscesses, and subacute infarcts. The pharmacokinetic parameters of MAGNEVIST in various lesions are not known.

CLINICAL TRIALS

MAGNEVIST Injection was administered to 1272 patients in open label controlled clinical studies. The mean age of these patients was 46.4 years (range 2 to 93 years). Of these patients, 55% (700) were male and 45% (572) were female. Of the 1271 patients who received MAGNEVIST Injection and for whom race was reported, 82.1% (1043) were Caucasian, 9.7% (123) were Black, 5.3% (67) were Hispanic, 2.1% (27) were Oriental/Asian, and 0.9% (11) were other. Of the 1272 patients, 550 patients were evaluated in blinded reader studies. These evaluated the use of contrast enhancement in magnetic resonance imaging of lesions in the head and neck, brain, spine and associated tissues, and body (excluding the heart). Of the 550 patients, all patients had a reason for an MRI and efficacy assessments were based on pre- and post- MAGNEVIST injection film quality, film contrast, lesion configuration (border, size, and location), and the number of lesions. The protocols did not include systematic verification of specific diseases or histopathologic confirmation of findings.

Of the above 550 patients, 97 patients received 0.1 mmol/kg MAGNEVIST Injection I. V. in two clinical trials of MAGNEVIST MRI contrast enhancement for body imaging. Of these 97, 68 had MRIs of the internal organs/structures of the abdomen or thorax (excluding the heart); 8 had breast images and 22 had images of appendages. The results of MRIs before and after MAGNEVIST use were compared blindly. Overall additional lesions were identified in 22/97 (23%) of the patients after MAGNEVIST Injection. The mean number of lesions identified before (1.49/patient) and after MAGNEVIST (1.75/patient) were similar. Seven (8%) of the patients had lesions seen before MAGNEVIST that were not seen after MAGNEVIST. Overall, after MAGNEVIST Injection, 41% of the images had a higher contrast score than before injection; and 18% of the images had a higher contrast score before MAGNEVIST Injection than after MAGNEVIST Injection. MAGNEVIST MRI of the 8 patients with

NDA 19-596-S-045/21-037/S-019

Page 16

breast images were not systematically compared to the results to mammography, breast biopsy or other modalities. In the 22 patients with appendage images (e. g., muscle, bone and intraarticular structures), MAGNEVIST MRI was not systematically evaluated to determine the effects of contrast biodistribution in these different areas.

Of the above 550 patients, 66 patients received MAGNEVIST 0.1 mmol/kg I. V. in clinical trials of MAGNEVIST MRI contrast enhancement of lesions in the head and neck. A total of 66 MRI images were evaluated blindly by comparing each pair of MRI images, before and after MAGNEVIST Injection. In these paired images, 56/66 (85%) had greater enhancement after MAGNEVIST and 40/66 (61%) had better lesion configuration or border delineation after MAGNEVIST. Overall, there was better contrast after MAGNEVIST in 55% of the images, comparable enhancement in 44 (36%) before and after MAGNEVIST, and better enhancement in 9% without MAGNEVIST.

In the studies of the brain and spinal cord, MAGNEVIST 0.1 mmol/kg I. V. provided contrast enhancement in lesions with an abnormal blood brain barrier.

In two studies, a total of 108 patients were evaluated to compare the dose response effects of 0.1 mmol/kg and 0.3 mmol/kg of MAGNEVIST in CNS MRI. Both dosing regimens had similar imaging and general safety profiles; however, the 0.3 mmol/kg dose did not provide additional benefit to the final diagnosis (defined as number of lesions, location and characterization).

INDICATIONS AND USAGE

Central Nervous System:

MAGNEVIST Injection is indicated for use with magnetic resonance imaging (MRI) in adults, and pediatric patients (2 years of age and older) to visualize lesions with abnormal vascularity in the brain (intracranial lesions), spine and associated tissues. MAGNEVIST Injection has been shown to facilitate visualization of intracranial lesions including but not limited to tumors.

Extracranial/ Extrapapinal Tissues:

MAGNEVIST is indicated for use with MRI in adults and pediatric patients (2 years of age and older) to facilitate the visualization of lesions with abnormal vascularity in the head and neck.

Body:

MAGNEVIST Injection is indicated for use in MRI in adults and pediatric patients (2 years of age and older) to facilitate the visualization of lesions with abnormal vascularity in the body (excluding the heart).

CONTRAINDICATIONS

None.

WARNINGS AND PRECAUTIONS

Nephrogenic Systemic Fibrosis (NSF)

Gadolinium-based contrast agents increase the risk for nephrogenic systemic fibrosis (NSF) in patients with acute or chronic severe renal insufficiency (glomerular filtration rate < 30 mL/min/1.73 m²) and in patients with acute renal insufficiency of any severity due to the hepato-renal syndrome or in the perioperative liver transplantation period. In these patients, avoid use of gadolinium-based contrast agents unless the diagnostic information is essential and not available with non-contrast enhanced

NDA 19-596-S-045/21-037/S-019

Page 17

MRI. For patients receiving hemodialysis, physicians may consider the prompt initiation of hemodialysis following the administration of a gadolinium-based contrast agent in order to enhance the contrast agent's elimination. The usefulness of hemodialysis in the prevention of NSF is unknown.

Among the factors that may increase the risk for NSF are repeated or higher than recommended doses of a gadolinium-based contrast agent and the degree of renal function impairment at the time of exposure.

Post-marketing reports have identified the development of NSF following single and multiple administrations of gadolinium-based contrast agents. These reports have not always identified a specific agent. Where a specific agent was identified, the most commonly reported agent was gadodiamide (OmniscanTM), followed by gadopentetate dimeglumine (Magnevist[®]) and gadoversetamide (OptiMARK[®]). NSF has also developed following sequential administrations of gadodiamide with gadobenate dimeglumine (MultiHance[®]) or gadoteridol (ProHance[®]). The number of post-marketing reports is subject to change over time and may not reflect the true proportion of cases associated with any specific gadolinium-based contrast agent.

The extent of risk for NSF following exposure to any specific gadolinium-based contrast agent is unknown and may vary among the agents. Published reports are limited and predominantly estimate NSF risks with gadodiamide. In one retrospective study of 370 patients with severe renal insufficiency who received gadodiamide, the estimated risk for development of NSF was 4% (J Am Soc Nephrol 2006; 17:2359). The risk, if any, for the development of NSF among patients with mild to moderate renal insufficiency or normal renal function is unknown.

Screen all patients for renal dysfunction by obtaining a history and/or laboratory tests. When administering a gadolinium-based contrast agent, do not exceed the recommended dose and allow a sufficient period of time for elimination of the agent prior to any readministration. (See **CLINICAL PHARMACOLOGY** and **DOSAGE AND ADMINISTRATION**).

Hypersensitivity reactions

Anaphylactoid and anaphylactic reactions with cardiovascular, respiratory and/or cutaneous manifestations rarely resulting in death have occurred. If such a reaction occurs, stop MAGNEVIST Injection and immediately begin appropriate therapy, including resuscitation.

Observe closely patients with a history of drug reactions, allergy or other hypersensitivity disorders, during and up to several hours after MAGNEVIST Injection.

Acute renal failure

In patients with renal insufficiency, acute renal failure requiring dialysis or worsening renal function have occurred, mostly within 48 hrs of MAGNEVIST Injection. The risk of these events is higher with increasing dose of contrast. Use the lowest possible dose and evaluate renal function in patients with renal insufficiency.

MAGNEVIST is cleared by glomerular filtration and is dialyzable.

Injection site reactions

Skin and soft tissue necrosis, thrombosis, fasciitis, and compartment syndrome requiring surgical intervention (e.g. compartment release or amputation) have occurred very rarely at the site of contrast injection or the dosed limb. Total volume and rate of MAGNEVIST Injection, extravasation of contrast

NDA 19-596-S-045/21-037/S-019

Page 18

agent, and patient susceptibility might contribute to these reactions. Phlebitis and thrombophlebitis may be observed generally within 24 hours after MAGNEVIST Injection and resolve with supportive treatment. Determine the patency and integrity of the intravenous line before administration of MAGNEVIST Injection. Assessment of the dosed limb for the development of injection site reactions is recommended.

Interference with Visualization of lesions visible with non-contrast MRI

As with any paramagnetic contrast agent, MAGNEVIST Injection might impair the visualization of lesions seen on non-contrast MRI. Therefore, caution should be exercised when MAGNEVIST MRI scans are interpreted without a companion non-contrast MRI scan.

NDA 19-596-S-045/21-037/S-019

Page 19

Patient counseling information

Patients scheduled to receive MAGNEVIST Injection should be instructed to inform their physician if they are pregnant, breast feed, or have a history of renal insufficiency, asthma or allergic respiratory disorders.

LABORATORY TEST FINDINGS

Transitory changes in serum iron, bilirubin and transaminase levels were observed in clinical trials.

MAGNEVIST Injection does not interfere with serum and plasma calcium measurements determined by colorimetric assays.

CARCINOGENESIS, MUTAGENESIS AND IMPAIRMENT OF FERTILITY Long term animal studies have not been performed to evaluate the carcinogenic potential of gadopentetate dimeglumine.

A comprehensive battery of *in vitro* and *in vivo* studies in bacterial and mammalian systems suggest that gadopentetate dimeglumine is not mutagenic or clastogenic and does not induce unscheduled DNA repair in rat hepatocytes or cause cellular transformation of mouse embryo fibroblasts. However, the drug did show some evidence of mutagenic potential *in vivo* in the mouse dominant lethal assay at doses of 6 mmol/kg, but did not show any such potential in the mouse and dog micronucleus tests at intravenous doses of 9 mmol/kg and 2.5 mmol/kg, respectively.

When administered intra-peritoneally to male and female rats daily prior to mating, during mating and during embryonic development for up to 74 days (males) or 35 days (females), gadopentetate caused a decrease in number of corpora lutea at the 0.1 mmol/kg dose level. After daily dosing with 2.5 mmol/kg suppression of food consumption and body weight gain (males and females) and a decrease in the weights of testes and epididymis were also observed.

In a separate experiment in rats, daily injections of gadopentetate dimeglumine over 16 days caused spermatogenic cell atrophy at a dose level of 5 mmol/kg but not at a dose level of 2.5 mmol/kg. This atrophy was not reversed within a 16-day observation period following the discontinuation of the drug.

PREGNANCY CATEGORY C.

Gadopentetate dimeglumine retarded fetal development slightly when given intravenously for 10 consecutive days to pregnant rats at daily doses of 0.25, 0.75, and 1.25 mmol/kg (2.5, 7.5 and 12.5 times the human dose based on body weight) and when given intravenously for 13 consecutive days to pregnant rabbits at daily doses of 0.75 and 1.25 mmol/kg (7.5 and 12.5 times the human dose respectively, based on body weight) but not at daily doses of 0.25 mmol/kg. No congenital anomalies were noted in rats or rabbits.

Adequate and well controlled studies were not conducted in pregnant women. MAGNEVIST Injection should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

NURSING WOMEN

MAGNEVIST is excreted in human milk. MAGNEVIST Injection was administered intravenously to 18 lactating women with normal renal function at a dose of 0.1 mmol/kg body weight. In these women, less than 0.04% of the administered gadolinium was excreted into the breast milk during the 24-hour period following dosing. Breast milk obtained during the 24 hours following dosing revealed the average cumulative amount of gadolinium excreted in breast milk was 0.57+/- 0.71 micromol. The

NDA 19-596-S-045/21-037/S-019

Page 20

amount transferred from a 70 kg woman (receiving 0.1 mmol/kg body weight) to an infant by breast feeding over a period of 24 hrs translates into less than 3 micromol of gadolinium.

The overall duration of excretion of gadolinium into breast milk is unknown. The extent of the absorption of MAGNEVIST Injection in infants and its effect on the breast-fed child remains unknown. Caution should be exercised when MAGNEVIST Injection is administered to a nursing woman.

PEDIATRIC USE

The use of MAGNEVIST in imaging the Central Nervous System, Extracranial/ Extrapapillary tissues, and Body have been established in the pediatric population from the ages of 2 to 16 years on the basis of adequate and well controlled clinical trials in adults and safety studies in this pediatric population. (See **CLINICAL TRIALS** for details.)

Safety and efficacy in the pediatric population under the age of 2 years have not been established. MAGNEVIST is eliminated primarily by the kidney. The pharmacokinetics of MAGNEVIST in neonates and infants with immature renal function have not been studied.

(See **INDICATIONS** and **DOSAGE AND ADMINISTRATION**)

ADVERSE REACTIONS

The mean age of the 1272 patients who received MAGNEVIST Injection was 46.4 years (range 2 to 93 years). Of these patients, 55% (700) were male and 45% (572) were female. Of the 1271 patients who received MAGNEVIST Injection and for whom race was reported, 82.1% (1043) were Caucasian, 9.7% (123) were Black, 5.3% (67) were Hispanic, 2.1% (27) were Oriental/Asian, and 0.9% (11) were other. The most common noted adverse event is headache with an incidence of 4.8%. The majority of headaches are transient and of mild to moderate severity. Nausea is the second most common adverse experience at 2.7%. Injection site coldness/localized coldness is the third most common adverse experience at 2.3%. Dizziness occurred in 1% of the patients.

The following additional adverse events occurred in fewer than 1% of the patients:

Body as a Whole: Injection site symptoms, namely, pain, localized warmth, and burning sensation; substernal chest pain, back pain, fever, weakness, generalized coldness, generalized warmth, localized edema, tiredness, chest tightness, trembling, shivering, tension in extremities, regional lymphangitis, pelvic pain, and anaphylactoid reactions (characterized by cardiovascular, respiratory and cutaneous symptoms) rarely resulting in death.

Cardiovascular: Hypotension, hypertension, arrhythmia, tachycardia, migraine, syncope, vasodilation, pallor, non-specific ECG changes, angina pectoris, death related to myocardial infarction or other undetermined causes, phlebitis, thrombophlebitis, deep vein thrombophlebitis, compartment syndrome requiring surgical intervention.

Digestive: Gastrointestinal distress, stomach pain, teeth pain, increased salivation, abdominal pain, vomiting, constipation, diarrhea.

Nervous System: Agitation, anxiety, thirst, anorexia, nystagmus, drowsiness, diplopia, stupor, convulsions (including grand mal), paresthesia.

NDA 19-596-S-045/21-037/S-019

Page 21

Respiratory System: Throat irritation, rhinorrhea, sneezing, dyspnea, wheezing, laryngismus, cough, respiratory complaints.

Skin: Rash, sweating, pruritus, urticaria (hives), facial edema, erythema multiforme, epidermal necrolysis, pustules.

Special Senses: Tinnitus, conjunctivitis, visual field defect, taste abnormality, dry mouth, lacrimation disorder (tearing), eye irritation, eye pain, ear pain.

OVERDOSAGE

Systemic consequences associated with overdosage of MAGNEVIST Injection have not been reported.

DOSAGE AND ADMINISTRATION

The recommended dosage of MAGNEVIST Injection is 0.2 mL/kg (0.1 mmol/ kg) administered intravenously, at a rate not to exceed 10 mL per 15 seconds. Dosing for patients in excess of 286 lbs has not been studied systematically.

NDA 19-596-S-045/21-037/S-019

Page 22

DOSE AND DURATION OF MAGNEVIST INJECTION BY BODY WEIGHT		
BODY WEIGHT		Total Volume, mL*
lb	kg	
22	10	2
44	20	4
66	30	6
88	40	8
110	50	10
132	60	12
154	70	14
176	80	16
198	90	18
220	100	20
242	110	22
264	120	24
286	130	26

*Rate of Injection: 10 mL/15sec

Drug Handling: To ensure complete injection of the contrast medium, the injection should be followed by a 5-mL normal saline flush. The imaging procedure should be completed within 1 hour of injection of MAGNEVIST Injection.

As with other gadolinium contrast agents, MAGNEVIST Injection has not been established for use in magnetic resonance angiography.

Parenteral products should be inspected visually for particulate matter and discoloration prior to administration. Do not use the solution if it is discolored or particulate matter is present.

Pharmacy Bulk Package Preparation: **NOT FOR DIRECT INFUSION**

The Pharmacy Bulk Package is used as a multiple dose container with an appropriate transfer device for filling empty sterile syringes.

- a) The transfer of MAGNEVIST Injection from the Pharmacy Bulk Package must be performed in an aseptic work area, such as a laminar flow hood, using aseptic technique.
- b) Once the Pharmacy Bulk Package is punctured, it should not be removed from the aseptic work area during the entire 24 hour period of use.
- c) The contents of the Pharmacy Bulk Package after initial puncture should be used within 24 hours.
- d) Any unused MAGNEVIST Injection must be discarded 24 hours after the initial puncture of the bulk package.

IV tubing and syringes used to administer MAGNEVIST Injection must be discarded at the conclusion of the radiological examination.

NDA 19-596-S-045/21-037/S-019

Page 23

Any unused portion must be discarded in accordance with regulations dealing with the disposal of such materials.

HOW SUPPLIED

MAGNEVIST Injection is a clear, colorless to slightly yellow solution containing 469.01 mg/mL of gadopentetate dimeglumine. MAGNEVIST Injection is supplied in the following sizes:

50 mL Pharmacy Bulk Package, rubber stoppered, 10 per box NDC 50419- 188- 58

50 mL Pharmacy Bulk Package (RFID), rubber stoppered, 10 per box NDC 50419- 188- 48

100 mL Pharmacy Bulk Package, rubber stoppered, 10 per box NDC 50419- 188- 11

100 mL Pharmacy Bulk Package (RFID), rubber stoppered, 10 per box NDC 50419- 188- 49

STORAGE

MAGNEVIST Injection should be stored at controlled room temperature, between 15-30° C (59- 86° F) and protected from light. DO NOT FREEZE. Should freezing occur in the bottle MAGNEVIST Injection should be brought to room temperature before use. If allowed to stand at room temperature for a minimum of 90 minutes, MAGNEVIST Injection should return to a clear, colorless to slightly yellow solution. Before use, examine the product to assure that all solids are redissolved and that the container and closure have not been damaged. Should solids persist, discard bottle.

U. S. Patent Nos. 5,362,475; 5,560,903 and, 5,876,695 relate to this product

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