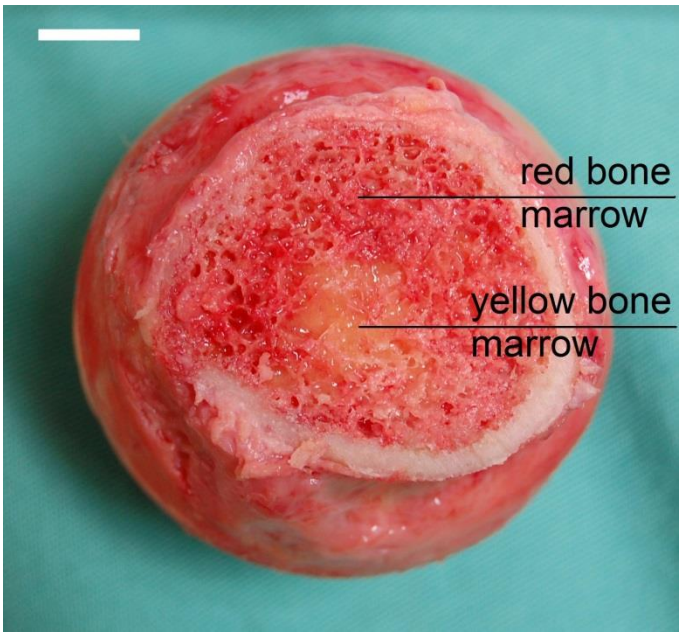
Cancer Association of South Africa (CANSA)

CANSA Fact Sheet on Multiple Myeloma

Introduction

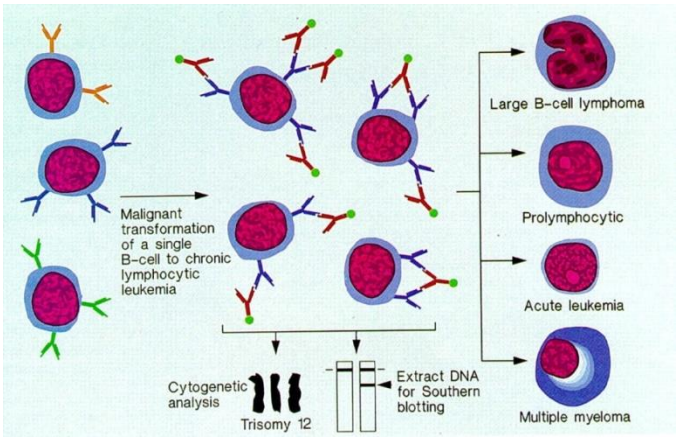
Multiple myeloma, also known as myeloma, is a haematologic cancer, or cancer of the blood.



[Picture Credit: Bone Marrow]

Multiple myeloma develops in the bone marrow, the soft, spongy centre of most bones. Myeloma typically occurs in bone marrow with the most activity, in the marrow in the spine, pelvic bones, ribs and area of the shoulders and hips. Many blood cells are produced in the bone marrow; myeloma affects plasma cells, cells that produce immunogobulins (antibodies) that help fight infection and disease.

[Picture Credit: Malignant Myeloma Cells]



In multiple myeloma, normal plasma cells transform into malignant myeloma cells and produce large quantities of an abnormal immunoglobulin called monoclonal (M) protein. The malignant cells also crowd out and inhibit the production of normal blood cells and antibodies in the bone marrow. In addition, groups of myeloma cells cause other cells in the bone marrow to remove the solid part of the bone and cause soft spots in the bone. These soft spots, also called osteolytic lesions, and other signs of bone loss are common with myeloma, although they do not occur in all individuals with myeloma.

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Vrtis, M.C. 2024.
"Multiple myeloma (MM) is a cancer that arises from plasma cells in bone marrow. Approximately 35,730 Americans received a new diagnosis and MM will claim the lives of an estimated 12,590 people in 2023. Complications of the disease process include anemia, leukopenia, thrombocytopenia, renal failure, severe pain, bone loss, and hypercalcemia. Patients with MM have a high risk for pathological fractures. For most forms of MM there are effective treatments that may result in long-term remission using multi-drug regimens. Although the medications approved in the United States to treat MM generally produce good outcomes, they have serious, and potentially life-threatening adverse effects. In addition, patients with specific genetic variations are at high risk for relapse. Communication with the oncology team and early intervention in the event of adverse effects of medications, complications of the disease process, or evidence of relapse are important to obtain the best possible outcome. Patients are easily overwhelmed with a three- to four-drug treatment regimen with some drugs given intravenously and/or subcutaneously at the clinic, and others taken orally at home on specific days of each 28-day cycle. Home care nursing is needed to assess for tolerance, adverse effects, and to address patient concerns. Medication management and teaching are very important in guiding patients to safely manage a schedule that changes daily. In addition, the high risk of pathological fractures and serious injury if the patient should fall supports the need for physical and occupational therapy fall prevention and safety education and exercise programs to help avert decline in functional status and combat cancer-related fatigue."

Liu, L. & Krishnan, A. 2024.
"Initial results of the phase I trial of talquetamab, a bispecific antibody targeting GPRC5D and CD3, were reported in December of 2022 for the treatment of relapsed or refractory multiple myeloma in the fourth line or later setting. It demonstrated a similar efficacy profile and durability of response to teclistamab, the first bispecific antibody therapy to be approved in multiple myeloma. Additionally, it has less infections than teclistamab but demonstrates unique class-specific side effects including skin, oral, and nail-related adverse events. Despite this, it is still a highly efficacious and well-tolerated therapy that will add to the armamentarium of therapeutics against heavily pretreated multiple myeloma."

Martino, E.A., Bruzzese, A., Labanca, C., Mendicino, F., Lucia, E., Olivito, V., Neri, A., Morabito, F., Vigna, E. & Gentile, M. 2024.
"Multiple myeloma (MM) is an incurable neoplasm characterized by significant morbidity and mortality. Despite advances in treatment, MM patients eventually experienced a relapse of the disease. Penta-drug refractory patients continue to be the hard core of relapsed/refractory (RR) settings. Teclistamab-cqyv is a humanized IgG4 antibody and a bispecific BCMA-director CD3 T-cell engager. It recruits endogenous T cells, by targeting CD3 receptors expressed on their surface, resulting in their activation against BCMA, an antigen expressed by plasma cells. US Food and Drug Administration (FDA) and European Medicines Agency (EMA) have approved Teclistamab-cqyv in monotherapy for the treatment of RRMM patients who have received at least three prior therapies, including immunomodulatory drugs (IMiDs), proteasome inhibitors (PIs), and anti-CD38 monoclonal antibodies (MoAbs) and have demonstrated disease progression during the last therapy. Its effectiveness was demonstrated in a pivotal clinical trial where the overall response rate (ORR) reached 60%. Other clinical studies are currently ongoing to investigate the association of the bispecific antibody with novel drugs with encouraging preliminary results, especially in the setting of heavily pretreated patients. In this review, the authors will provide a comprehensive overview of the drug, including its mechanism of action, major clinical trials, and future perspectives."

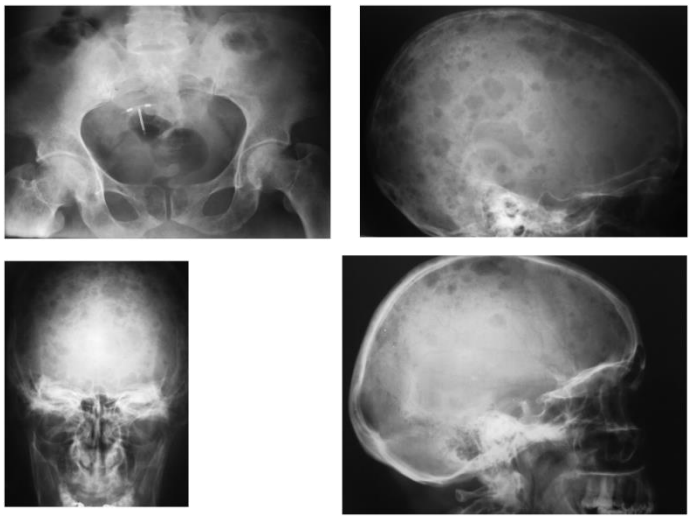
Importance of Vaccination for Individuals with Multiple Myeloma

Vaccination is particularly important in patients with multiple myeloma, who have an increased risk of infections due to the disease-inherent immune suppression, and because of the immune suppressive effects of therapy.

Osteolytic Lesions

Osteolytic lesions, also called osteoclastic lesions or lytic lesions (for short), are characteristic areas of damage caused by myeloma. When myeloma invades bone tissue, it causes weak areas to form. In addition, the myeloma cells release chemicals that also lead to bone breakdown. The result is lesions with a specific 'punched-out' appearance that may occur in any bone in the body, but are most often noted in the spine, skull, pelvis and ribs.

[Picture Credit: Osteolytic Lesions]



The International Classification of Disease 10th Version (ICD-10)

The International Classification of Diseases (ICD) is designed to promote international comparability in the collection, processing, classification, and presentation of mortality statistics. This includes providing a format for reporting causes of death on the death certificate.

ICD serves a broad range of uses globally and provides critical knowledge on the extent, causes and consequences of human disease and death worldwide via data that is reported and coded with the ICD. Clinical terms coded with ICD are the main basis for health recording and statistics on disease in primary, secondary and tertiary care, as well as on cause of death certificates. These data and statistics support payment systems, service planning, administration of quality and safety, and health services research. Diagnostic guidance linked to categories of ICD also standardizes data collection and enables large scale research.

For more than a century, the International Classification of Diseases (ICD) has been the basis for comparable statistics on causes of mortality and morbidity between places and over time. Originating in the 19th century, the latest version of the ICD, ICD-11, was adopted by the 72nd World Health Assembly in 2019 and came into effect on 1st January 2022.

The ICD-10 Code for multiple myeloma – C90.00.

Incidence of Multiple Myeloma in South Africa

According to the latest edition of the National Cancer Registry (2022) the following numbers of Myeloma cases were histologically diagnosed in South Africa during 2022. Histologically diagnosed means that a specimen (biopsy) was taken and forwarded to a recognised laboratory where a specially trained pathologist confirmed a diagnosis of cancer.

Group - Males 2022	Actual No of Cases	Estimated Lifetime Risk	Percentage of All Cancers
All males	234	1:842	0,56%
Asian males	6	1:1 369	0,57%
Black males	113	1:1 145	0,72%
Coloured males	23	1:1 176	0,46%
White males	92	1:414	0,42%

Group - Females 2022	Actual No of Cases	Estimated Lifetime Risk	Percentage of All Cancers
All females	229	1:1 187	0,50%
Asian females	4	1:2 218	0,28%
Black females	117	1:1 430	0,55%
Coloured females	18	1:2 568	0,32%
White females	90	1:553	0,49%

The frequency of histologically diagnosed cases of Myeloma in South Africa for 2022 was as follows (National Cancer Registry, 2022):

Group - Males 2022	0 – 19 Years	20 – 29 Years	30 – 39 Years	40 – 49 Years	50 – 59 Years	60 – 69 Years	70 – 79 Years	80+ Years
All males	0	1	9	29	59	73	49	14
Asian males	0	0	0	0	0	3	3	0
Black males	0	0	8	18	40	34	9	4
Coloured males	0	1	1	3	5	6	6	2
White males	0	0	0	8	14	31	31	8

Group - Females 2022	0 – 19 Years	20 – 29 Years	30 – 39 Years	40 – 49 Years	50 – 59 Years	60 – 69 Years	70 – 79 Years	80+ Years
All females	0	0	7	20	49	61	69	23
Asian females	0	0	0	0	1	1	2	0
Black females	0	0	3	17	35	36	20	6
Coloured females	0	0	0	1	2	3	9	3
White females	0	0	4	2	11	21	38	14

N.B. In the event that the totals in any of the above tables do not tally, this may be the result of uncertainties as to the age, race or sex of the individual. The totals for 'all males' and 'all females', however, always reflect the correct totals.

Symptoms of Multiple Myeloma

Myeloma may not cause any symptoms in the early stages of the disease. Occasionally, it is diagnosed following a routine blood test before any symptoms develop. When symptoms do occur, they are mostly caused by a build-up of abnormal plasma cells in the bone marrow, and by the presence of the para-protein in the blood.

Bone pain - The most common symptom of myeloma is bone pain. About 70% of people complain of lower back pain, or pain in their ribs. The pain happens because too many abnormal plasma cells are crowding out the bone marrow, which can damage the bone. Other bones may be affected too, such as the skull or pelvis.

Other symptoms may include:

- tiredness and fatigue due to a lack of red blood cells (anaemia)
- kidney problems, which are caused by the para-proteins produced by the myeloma cells. They can also cause tiredness and anaemia
- repeated infections, particularly chest infections, due to a shortage of normal antibodies
- loss of appetite, feeling sick, constipation, depression and drowsiness, which are caused by too much calcium in the blood (hypercalcaemia)
- unexplained bruising and abnormal bleeding, for example nosebleeds or bleeding gums, due to a reduced number of platelets in the blood
- weight loss

If a person has any of these symptoms, it is important to see a doctor as soon as possible. Many of these symptoms can also occur in other conditions - most people with these symptoms will not have multiple myeloma.

Causes and Risk Factors for Multiple Myeloma

No cause for myeloma has so far been identified. Some research has suggested possible associations with a decline in the immune system, specific occupations, exposure to certain chemicals (heavy metals), and exposure to radiation. Exposure to herbicides, insecticides, petroleum products, heavy metals, plastics, and various dusts including asbestos also appear to be risk factors for the disease. However, none of these associations is strong, and in most cases, multiple myeloma develops in individuals who have no known risk factors.

Genetic factors may also be involved in the development of multiple myeloma. Learn more about genetic abnormalities in multiple myeloma. Researchers believe that multiple myeloma is most likely the result of several factors acting together. The most significant risk factor for multiple myeloma is age, as 96% of cases are diagnosed in people older than 45 years, and more than 63% are diagnosed in people older than 65 years.

Diagnosis of Multiple Myeloma

The following tests may be done to diagnose multiple myeloma:

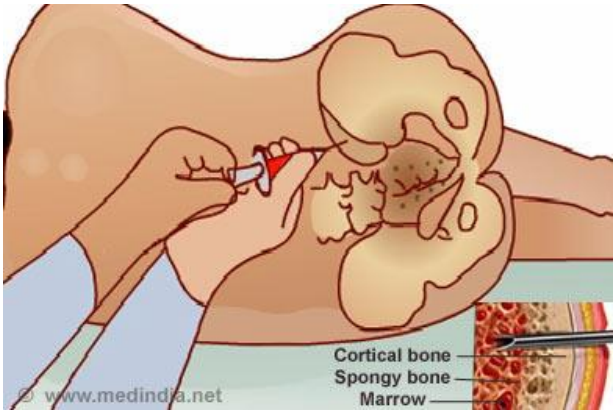
A blood test called serum protein electrophoresis separates the blood proteins and can detect the presence of monoclonal proteins (M proteins) — referred to as an "M spike" — in the blood.

Other tests may include:

- Imaging - X-rays of the skeleton can show whether the bones have any thinned-out areas (osteolytic lesions), common in multiple myeloma. If a closer view of the bones is necessary, the

doctor may use magnetic resonance imaging (MRI), computerised tomography (CT) scanning or positron emission tomography (PET) scanning.

- Bone marrow examination - the doctor may also conduct a bone marrow examination (biopsy) by using a needle to remove a small sample of bone marrow tissue. The sample is then examined under a microscope to check for myeloma cells. A portion of the sample is also tested for chromosome abnormalities using tests such as fluorescence *in situ* hybridisation (FISH).



[Picture Credit: Bone Marrow Biopsy]

- Tests may also be done to measure the rate at which the plasma cells are dividing.

Treatment of Multiple Myeloma

Because currently there is no known cure for multiple myeloma, understanding the standard treatments - and the treatment options - is critical in attempting to prolong survival and maintain the patient's overall functional ability and quality of life. Aspects of importance in the treatment of multiple myeloma may include:

- Which patients with multiple myeloma are candidates for an approach known as 'watchful waiting', where the progress of the disease is monitored carefully but no specific treatment is required
- The various phases in the treatment of multiple myeloma for patients whose disease has progressed to the point where treatment becomes necessary. These treatment phases are grouped into the following categories:
  - initial or induction chemotherapy
  - consolidation therapy
  - maintenance therapy
  - salvage therapy
- The role of stem cell transplantation in the management of patients with multiple myeloma, including the risks and benefits of this procedure
- The treatment options available to patients with multiple myeloma who experience a relapse or recurrence of the disease after initially having gone into remission
- The role of plasmapheresis - the direct removal of abnormal antibody proteins from the bloodstream - in the management of patients with multiple myeloma
- A detailed overview of the risk of infections in people with multiple myeloma, including practical recommendations for reducing the risks of developing potentially life-threatening bacterial, viral, and fungal infections
- The treatment options that are available for the management of patients with multiple myeloma who develop myeloma bone disease - areas of bone destruction caused by multiple myeloma that significantly increase the risk of developing pathologic fractures
- The prognosis (outlook) for people with multiple myeloma and important prognostic factors that have a significant impact in predicting the overall chances of recovery and survival
- The role of complementary therapies in the management of people with multiple myeloma

- Quality of life issues such as sleep disorders, fatigue, weight loss, and psychological stress that often confront people with multiple myeloma and tips for how to minimize their impact and better cope with these important issues

If one has multiple myeloma and is not experiencing any symptoms, he/she may not need treatment. However, the doctor will regularly monitor the patient's condition for signs the disease is progressing. If it is, the patient may need treatment. If one is experiencing symptoms, treatment can help relieve pain, control complications of the disease, stabilise the condition and slow the progress of the disease.

Treatments for Multiple Myeloma may Include:
Though there's no cure for multiple myeloma, with good treatment results one can usually return to near-normal activity.

Chemotherapy. Chemotherapy may be given orally or given through an intravenous (IV) injection. Chemotherapy is often given in cycles over a period of months, followed by a rest period.

Corticosteroids. Corticosteroids, such as prednisone and dexamethasone, have been used for decades to treat multiple myeloma. They are typically given in pill form.

Stem cell transplantation. This treatment involves using high-dose chemotherapy along with transfusion of previously collected immature blood cells (stem cells) to replace diseased or damaged marrow.

Radiation therapy. This treatment uses high-energy penetrating waves to damage myeloma cells and stop their growth.

Treatments for relapsed or treatment-resistant multiple myeloma
Most people who are treated for multiple myeloma eventually experience a relapse of the disease. In some cases, none of the currently available, first line therapies slow the cancer cells from multiplying. If the patient experiences a relapse of multiple myeloma, the doctor may recommend repeating another course of the treatment that initially helped. Another option is trying one or more of the other treatments typically used as first line therapy, either alone or in combination.

Treating Complications of Multiple Myeloma
Because multiple myeloma can cause a number of complications, one may also need treatment for those specific conditions.

About Clinical Trials
Clinical trials are research studies that involve people. They are conducted under controlled conditions. Only about 10% of all drugs started in human clinical trials become an approved drug.

Clinical trials include:
- Trials to test effectiveness of new treatments
- Trials to test new ways of using current treatments
- Tests new interventions that may lower the risk of developing certain types of cancers

- Tests to find new ways of screening for cancer

The South African National Clinical Trials Register provides the public with updated information on clinical trials on human participants being conducted in South Africa. The Register provides information on the purpose of the clinical trial; who can participate, where the trial is located, and contact details.

For additional information, please visit: https://pactr.samrc.ac.za/

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Sources and References Consulted or Utilised

About.Com
http://lymphoma.about.com/od/glossary/g/Osteolytic-Lesions.htm

American Cancer Society
http://www.cancer.org/cancer/multiplemyeloma/detailedguide/multiple-myeloma-staging

Bell, J.C. 2014. Taming measles virus to create an effective cancer therapeutic. *Mayo Clinical Proceedings*, XXX:1-3. www.mayoclinicproceedings.org.

Bhatt, P., Kloock, C. & Comenzo, R. 2023. Relapsed/Refractory Multiple Myeloma: A Review of Available Therapies and Clinical Scenarios Encountered in Myeloma Relapse. *Curr Oncol*. 2023 Feb 15;30(2):2322-2347.

Bone Marrow
https://www.google.co.za/search?q=bone+marrow&source=lnms&tbm=isch&sa=X&ei=6sH7UeKjGc-IhQe844CQAQ&ved=0CAcQ_AUoAQ&biw=1366&bih=614#facrc=_&imgdii=_&imgrc=P67x5vDFaKlXJM%3A%3BFGuOpzUGSy_l5M%3Bhttp%253A%252F%252Fsicklecellbodypolitics.files.wordpress.com%252F2011%252F04%252Fbonemarrow2.jpg%3Bhttp%253A%252F%252Fsicklecellbodypolitics.wordpress.com%252Ftreatment-and-research%252Fprimary-medical-treatments%252Ftransplantation%252Fwhat-is-bone-marrow%252F%3B1681%3B1557

Bone Marrow Biopsy
https://www.google.co.za/search?q=bone+marrow+biopsy&source=lnms&tbm=isch&sa=X&ei=oLj7UY-dEtCWhQfYlYCwDg&sqi=2&ved=0CAcQ_AUoAQ&biw=1366&bih=614#facrc=_&imgdii=_&imgrc=utO8gXeVC897CM%3A%3BBh4VfSdOAbQ0mM%3Bhttp%253A%252F%252Fwww.medindia.net%252Fpatients%252Fpatientinfo%252Fimages%252Fbone-marrow-biopsy.jpg%3Bhttp%253A%252F%252Fwww.medindia.net%252Fpatients%252Fpatientinfo%252Fbone-marrow-aspiration-and-biopsy.htm%3B390%3B260

Cancer Research UK
http://www.cancerresearchuk.org/cancer-help/type/melanoma/treatment/stages-of-melanoma#clark

Costa, L.J. & Usmani, S.Z. 2020. Defining and managing high-risk multiple myeloma: current concepts. 2020. J Natl Compr Canc Netw. 2020 Dec 2;18(12):1730-1737.

Cowan, A.J., Green, D.J., Kwok, M., Lee, S., Coffey, D.G., Holmberg, L.A., Tuazon, S., Gopal, A.K. & Libby, E.N. 2022. Diagnosis and Management of Multiple Myeloma: A Review. *JAMA*. 2022 Feb 1;327(5):464-477.

Diaz-delCastillo, M., Chantry, A.D., Lawson, M.A. & Heegaard, A.M. 2021. Multiple myeloma-A painful disease of the bone marrow. *Semin Cell Dev Biol*. 2021 Apr;112:49-58.

Durer, C., Durer, S., Lee, S., Chakraborty, R., Malik, M.N., Rafae, A., Zar, M.A., Kamal, A., Rosko, N., Samaras, C., Valent, J., Chaulagain, C. & Answer, F. 2020. Treatment of relapsed multiple myeloma: Evidence-based recommendations. *Blood Rev*. 2020 Jan;39:100616.

Goel, U., Usmani, S. & Kumar, S. 2022. Current approaches to management of newly diagnosed multiple myeloma. *Am J Hematol*. 2022 May;97 Suppl 1:S3-S25.

Gupta, N., Sharma, A. & Shrama, A. 2020. Emerging biomarkers in multiple myeloma: a review. *Clin Chim Acta*. 2020 Apr;503:45-53.

Guzdar, A. & Costello, C. 2020. Supportive Care in Multiple Myeloma. Curr Hematol Malig Rep. 2020 Apr;15(2):56-61.

Kelly, E. & Russell, S.J. 2007. History of oncolytic viruses: genesis to genetic engineering. Molecular Therapy, 15(4):651-659.

Kehrer, M., Koob, S., Strauss, A., Wirtz, D.C. & Schmolders, J. 2017. Multiple Myeloma – current status in diagnostic testing and therapy. *Z Orthop Unfall*. 2017 Oct;155(5):575-586. doi: 10.1055/s-0043-110224. Epub 2017 Aug 14.

Kim., C., Bhatta, S., Cyprien, L., Fonseca, R. & Hernancez, R.K. 2018. Incidence of skeletal-related events among multiple myeloma patients in the United States at oncology clinics: observations from real-world data. *J Bone Oncol*. 2018 Dec 26;14:100215. doi: 10.1016/j.jbo.2018.100215. eCollection 2019 Feb.

Kumar, S.K., Callander, N.S., Adekola, K., Anderson, L., Baljevic, M., Campagnaro, E., Castillo, J.J., Chandler, J.C., Costello, C., Efebera, Y., Faiman, M., Garfall, A., Godby, K., Hillengass, J., Holmberg, L., Htut, M., Huff, C.A., Kang, Y., Hultcrantz, M., Larson, S., Liedtke, M., Martin, T., Omel, J., Shain, K., Sborov, D., Stockerl-Goldstein, K., Weber, D., Keller, J. & Kumar, R. 2020. Multiple Myeloma, Version 3.2021, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw*. 2020 Dec 2;18(12):1685-1717.

Kumar, S.K., Raikumar, V., Kyle, R.A., van Duin, M., Sonneveld, P., Mateos, M.V., Gay, F. & Anderson, K.C. 2017. Multiple myeloma. *Nat Rev Dis Primers*. 2017 Jul 20;3:17046. doi: 10.1038/nrdp.2017.46.

Liu, L. & Krishnan, A. 2024. Talquetamab in multiple myeloma. *Haematologica*. 2024 Mar 1;109(3):718-724.

Lonial, S., Lee, H.C., Badros, A., Trudel, S., Nooka, A.K., Chari, A., Abdallah, A.O., Callander, N., Lendvai, N., Sborov, D., Suvannasankha, A., Weisel, K., Karlin, L., Libby, E., Arnulf, B., Facon, T., Hulin, C., Kortüm, K.M., Rodríguez-Otero, P., Usmani, S.Z., Hari, P., Baz, R., Quach, H., Moreau, P., Voorhees, P.M., Gupta, I., Hoos, A., Zhi, E., Baron, J., Piontek, T., Lewis, E., Jewell, R.C., Dettman, E.J., Popat, R., Esposti, S.D., Opalinska, J., Richardson, P. & Cohen, A.D. 2020. Belantamab madodotin for relapsed or refractory multiple myeloma (DREAM-2): a two-arm, randomised, open-label, phase 2 study. *Lancet Oncol*. 2020 Feb;21(2):207-221.

Ludwig, H., Boccadoro, M., Moreau, P., San-Miguel, J., Cavo, M., Pawlyn, C., Zweegman, S., Facon, T., Driessen, C., Hajek, R., Dimopoulos, M.A., Gay, F., Avet-Loiseau, H., Terpos, E., Zojer, N., Mohty, M., Mateos, M.V., Einsele, H., Delforge, M., Caers, J., Weisel, K., Jackson, G., Garderet, L., Engelhardt, M., van de Donk, N., Leleu, X., Goldschmidt, H., Beksac, M., Nijhof, I., Abildgaard, N., Bringhen, S. & Sonneveld, P. 2021. Recommendations for vaccination in multiple myeloma: a consensus of the European Myeloma Network. *Leukemia*. 2021 Jan;35(1):31-44.

MacMillan Cancer Support
http://www.macmillan.org.uk/Cancerinformation/Cancertypes/Myeloma/Symptomsdiagnosis/Symptoms.aspx

Malignant Myeloma Cells
https://www.google.co.za/search?q=multiple+myeloma&source=lnms&tbm=isch&sa=X&ei=aq77UdCKO8TK0AX23oGQBA&ved=0CAcQ_AUoAQ&biw=1366&bih=614#facrc=_&imgdii=_&imgrc=a0uN5BnukO9urM%3A%3BVRltAIAbAn27fM%3Bhttp%253A%252F%252Fannals.org%252Fdata%252FJournals%252FAIM%252F19777%252F11FF1.jpeg%3Bhttp%253A%252F%252Fannals.org%252Farticle.aspx%253Farticleid%253D706496%3B1280%3B822

Martino, E.A., Bruzzese, A., Labanca, C., Mendicino, F., Lucia, E., Olivito, V., Neri, A., Morabito, F., Vigna, E. & Gentile, M. 2024. Teclistamab-cqyv in multiple myeloma. *Eur J Haematol.* 2024 Mar;112(3):320-327.

Mayo Clinic
http://www.mayoclinic.com/health/multiple-myeloma/DS00415/DSECTION=tests-and-diagnosis
http://www.mayoclinic.com/health/multiple-myeloma/DS00415/DSECTION=treatments-and-drugs

Medifocus
http://www.multiplemyeloma-guidebook.com/2009/landingp2.php?gid=HM008&?a=a&assoc=Google&keyword=multiplemyeloma

Minnie, S.A. & Hill, G.R. 2020. Immunotherapy of multiple myeloma. *J Clin Invest*. 2020 Apr 1;130(4):1565-1575.

MPR
http://www.empr.com/news/darzalex-daratumumab-pomalidomide-dexamethasone-multiple-meloma/article/669415/?DCMP=EMC-MPR_DailyDose_cp_20170619&cpn=hemonc_all&hmSubId=i7VmYKZCM_41&hmEmail=OdsiBxRYPdkldpZ00Ap-a5dX4uYlpfYu0&NID=&c_id=&dl=0&spMailingID=17486417&spUserID=MzMyODk3NTcxNTcS1&spJobID=1041457310&spReportId=MTA0MTQ1NzMxMAS2

Ms Stacy Erholtz
https://www.google.co.za/search?q=Ms+Stacy+Erholtz&source=lnms&tbm=isch&sa=X&ei=S7eaU9X5HK-v7Aba5YH4Bg&ved=0CAYQ_AUoAQ&biw=1517&bih=714&dpr=0.9#facrc=_&imgdii=_&imgrc=4df2T2uKhj37LM%253A%3BgXM8ecwVmZ7pgM%3Bhttp%253A%252F%252Fi2.cdn.turner.com%252Fcnn%252Fdam%252Fassets%252F140518151715-newsroom-intv-stacy-erholtz-cancer-survivor-00010306-story-top.jpg%3Bhttp%253A%252F%252Fwww.cnn.com%252F2014%252F05%252F15%252Fhealth%252Fmeasles-cancer-remission%252F%3B640%3B360

Multiple Myeloma Research Foundation
http://www.themmrf.org/living-with-multiple-myeloma/newly-diagnosed-patients/what-is-multiple-myeloma/

National Cancer Institute
http://www.cancer.gov/clinicaltrials/learningabout/what-are-clinical-trials

Ntanasis-Stathopoulos, I., Gavriatopoulou, M. & Terpos, E. 2020. Antibody therapies for multiple myeloma. *Expert Opin Biol Ther*. 2020 Mar;20(3):295-303.

Osteolytic Lesions
https://www.google.co.za/search?q=multiple+myeloma&source=lnms&tbm=isch&sa=X&ei=aq77UdCKO8TK0AX23oGQBA&ved=0CAcQ_AUoAQ&biw=1366&bih=614#facrc=_&imgdii=_&imgrc=jkc6XvyLe64yPM%3A%3BvNL2lWoXRvxnrM%3Bhttp%253A%252F%252Fapi.ning.com%252Ffiles%252FzPssDF8oq4NCcFD*O*qRHoIZceIYqUeWDMfBOdZf8Iry5yIu4i574ASyd1wsxFCQgt0i7gVQlqAgDeIRL477NWpp-1-i7gRq%252FMultipleMyeloma.png%3Bhttp%253A%252F%252Fwww.radrounds.com%252Fphoto%252Fmultiple-myeloma-2%3B1357%3B1010

Parikh, R.H. & Lonial, S. 2023. Chimeric antigen receptor T-cell therapy in multiple myeloma: A comprehensive review of current data and implications for clinical practice. *CA Cancer J Clin*. 2023 May-Jun;73(3):275-285.

Pertesi, M., Went, M., Hansson, M., Hemminki, K., Houlston, R.S. & Nilsson, B. 2020. Genetic predisposition for multiple myeloma. *Leukemia*. 2020 Mar;34(3):697-708.

Rajkumar, S.V. 2022. Multiple myeloma: 2022 update on diagnosis, risk stratification, and management. *Am J Hematol*. 2022 Aug;97(8):1086-1107.

Russell, S.J., Federspeil, M.J., Peng, K.W., Tong, C., Dingli, D., Morine, W.G., Lowe, V., O'Connot, M.K., Kyle, R.A., Leung, N., Buadi, F.K., Rajkumar, S.V., Gertz, M.A., Lacy, M.Q. & Dispenzieri, A. 2014. Remission of disseminated cancer after systemic oncolytic virotherapy. *Mayo Clinic Proceedings*, XXX:1-8. www.mayoclinicproceedings.org.

Shah, U.A. & Mailankody, S. 2020. Emerging immunotherapies in multiple myeloma. *BMJ*. 2020 Sep 21;370:m3176.

Stadtmauer, E.A., Pasquini, M.C., Blackwell, B., Hari, P., Bashey, A., Devine, S., Efebera, Y., Ganguly, S., Gasparetto, C., Geller, N., Horowitz, M.M., Koreth, J., Knust, K., Landau, H., Brunstein, C., McCarthy, P., Nelson, C., Qazilbash, M.H., Shah, N., Vesole, D.H., Vij, R., Vogl, D.T., Giralt, S., Somlo, G. & Krishnan, A. 2019. Autologous Transplantation, Consolidation, and Maintenance Therapy in Multiple Myeloma. *J Clin Oncol*. 2019 Jan 17:JCO1800685. doi: 10.1200/JCO.18.00685. [Epub ahead of print]

The International Classification of Diseases 10th version (ICD-10)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2842174/#:~:text=Malignant%20rhabdoid%20tumors%20(MRTs)%20are, particularly%20in%20the%20soft%20tissues.
https://www.dana-farber.org/childhood-malignant-rhabdoid-tumor/
https://medlineplus.gov/genetics/condition/rhabdoid-tumor-predisposition-syndrome/
https://www.hindawi.com/journals/cripu/2014/950869/
https://jmedicalcasereports.biomedcentral.com/articles/10.1186/s13256-017-1554-2
http://www.cancerindex.org/ccw/guide3g.htm
https://www.dana-farber.org/childhood-malignant-rhabdoid-tumor/#:~:text=Diagnostic%20procedures%20for%20malignant%20rhabdoid,to%20test%20for%20genetic%20mutation.

van de Donk, N.W.C.J, Pawlyn, C. & Yong, K.L. 2021. Multiple myeloma. *Lancet*. 2021 Jan 30;397(10272):410-427.

Vrtis, M.C. 2024. Multiple myeloma. *Home Healthc Now*. 2024 May-Jun;42(3):140-149.