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Original Paper

AI Positioning and Navigation, Robot Operation, Precise Intervention of Chemotherapy Drugs into the Osteolytic Destruction Area of the Distal Femoral Metaphysis, Implementing Direct Chemotherapy within the Solid Tumor of Osteosarcoma

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Abstract

MAP regimen is a classic chemotherapy protocol for osteosarcoma. On the basis of MAP reginen, we have made three adjustments and ultimately developed an innovative regimen for direct chemotherapy in the solid tumor of osteosarcoma specifically tailored for this patient:

1). Adjust the drug supply method from intravenous infusion to static pulse injection pump micro-volume slow push

2). By AI positioning navigation, robot operation, static pulse injection pump micro-volume slow push, the chemotherapy drugs are accurately involved into the osteolytic destruction area of osteosarcoma, and implementing direct chemotherapy in the solid tumor of osteosarcoma.

3). Combined with autologous leukocyte implantation

The patient successfully completed the direct chemotherapy in the solid tumor of osteosarcoma, combined with autologous leukocyte implantation for 4 cycles before operation, the tumor volume was reduced by about 50%, tumor was sensitive to chemotherapy, with a tumor necrosis rate of over 90%, the clinical stage has been downstaged from IIA to a potentially resectable status, with clear boundaries and no distant metastasis, providing a favorable condition for surgical resection. Compared to targeted therapy and nanotechnology, this is a more direct and more precise approach to intratumoral chemotherapy. It indeed can increase the concentration of chemotherapeutic drugs within tumors by focusing drug delivery to the tumor site, enhancing the direct killing effect on tumor targets

while potentially reducing systemic side effects.

The next step in the research plan is to implement direct chemotherapy in the solid tumor of malignant bone tumor while combining it with animal leukocyte transplantation, fully utilizing the particularity of immune rejection under the condition of confined space in a solid tumor to destroy the tumor microenvironment.

Keywords

AI positioning navigation, robot operation, chemotherapy drugs, direct chemotherapy, animal leukocytes, particularity of immune rejection, destroy the tumor microenvironment

Introduction

Miss Liu, 21 years old, developed persistent dull pain in her right knee two months ago without obvious cause. The pain worsened at night and after activity, and slightly improved with rest, accompanied by local swelling, distended superficial veins, and increased skin temperature. One week ago, the pain worsened, making walking difficult. She came to our hospital for consultation on June 28, 2025.

Physical examination:

Local swelling of the right knee joint, local superficial vein filling, slightly high skin temperature, obvious tenderness, limited movement, negative patellar float test, normal peripheral vascular pulsation.

Imaging examination:

X-ray film showed osteolytic destruction of the right femur metaphysis, unclear boundary, bone cortex interruption, Codman triangle and solar radiation periosteal reaction.

MRI examination indicates the following :

1). Bone change: A localized bone destruction area can be seen at the distal metaphysis of the right femur, the boundary is unclear, the T1 weighted image is low, and the T2 weighted image shows an uneven high signal, indicating the formation of tumor bone and bone matrix.

2). Soft tissue invasion: An irregular mass of 15cm x 16cm can be seen in the soft tissue around the tumor, and the signal strength is consistent with that of the tumor body. There is a high signal on the T2 weighted image, and the fat inhibition sequence is clearer, indicating that the tumor invades the surrounding muscles and adipose tissue.

3). Joint and vascular nerve bundle relationship: The tumor does not involve the knee joint cavity, and the boundary with the femoral artery, femoral vein and saphenous nerve is still clear, and there is no obvious compression or infiltration.

4). Jumping metastasis: MRI did not find a jumping metastasis in other parts of the bone.

The initial diagnosis was osteosarcoma of the distal metaphysis of the right femur and was admitted to the hospital.

After admission, aspiration biopsy was performed immediately, and the high-resolution digital images

generated from the scanned pathological sections as well as the original DR and MRI image data were uploaded to the hospital's PACS. The AI analyzed the uploaded image data through deep learning algorithms, quickly identified abnormalities, assisted doctors in making judgments, and ultimately confirmed a diagnosis of low-grade osteosarcoma in the distal metaphysis of right femur (Enneking stage: IIA) (Artem Shmatko, Narmin Ghaffari Laleh, Moritz Gerstung, & Jakob Nikolas Kather, 2024).

1. Establish an Innovative Reginen for Direct Chemotherapy in the Solid Tumor of Osteosarcoma (Zhao Ming et al., 2023; Shao Haibo et al., 2025)

How to utilize AI for positioning and navigation, robot operation, to precisely deliver chemotherapeutic drugs into the osteolytic destruction area of osteosarcoma, implement direct intratumoral chemotherapy for the osteosarcoma, effectively increase the drug concentration within the tumor, enhancing the direct killing effect on tumor targets while reducing systemic toxicity, is the actual requirement of chemotherapy in clinical practice and the ultimate goal of our pursuit of chemotherapy innovation.

MAP regimen is a classic chemotherapy protocol for osteosarcoma. On the basis of MAP reginen, we have made three adjustments and ultimately developed an innovative regimen for direct chemotherapy in the solid tumor of osteosarcoma specifically tailored for this patient. The details are as follows:

1). Adjust the drug supply method from intravenous infusion to static pulse injection pump micro-volume slow push

2). By AI positioning navigation, robot operation, static pulse injection pump micro-volume slow push, the chemotherapy drugs are accurately involved into the osteolytic destruction area at the distal femoral metaphysis, implementing direct chemotherapy in the solid tumor of osteosarcoma.

3). Combined with autologous leukocyte implantation

The patient is 1.62 meters tall and weighs 50kg. The patient's body surface area (BSA) is approximately 1.58 m^2, calculated by the Mosteller formula.

Methotrexate (MTX)

Total dose: $8g/m^2 \times 1.58m^2=12.64g$

Usage: static pulse injection pump micro-volume slow push for 10 hours

Time: Day 1

Precautions: Leucovorin calcium (CF) rescue is required, typically initiated 6 hours after the completion of MTX infusion, administered every 6 hours for a total of 12 doses (3 days).

Adriamycin (ADM)

Total dose: $60mg/m^2 \times 1.58m^2 = 94.8mg$.

Usage: static pulse injection pump micro-volume slow push

Time: Day 9

Cisplatin (DDP)

Total dose: $120\ mg/m^2 \times 1.58m^2=94.8 \times 2mg$

Usage: static pulse injection pump micro-volume slow push (split infusion, half dose each time)

Time: Day 7, Day 21

Chemotherapy cycle and procedure:

1). Cycle repeats every 28 days.

2). Preoperative direct chemotherapy: administer 2-4 cycles to reduce tumor volume, followed by elective surgery for tumor resection.

3). Postoperative adjuvant chemotherapy: adjust the regimen based on tumor necrosis and complete 4-8 cycles of direct chemotherapy in the postoperative residual bony lesion area. If efficacy needs to be enhanced, other drugs such as ifosfamide can be considered to be combined with the MAP regimen, forming the MAID regimen.

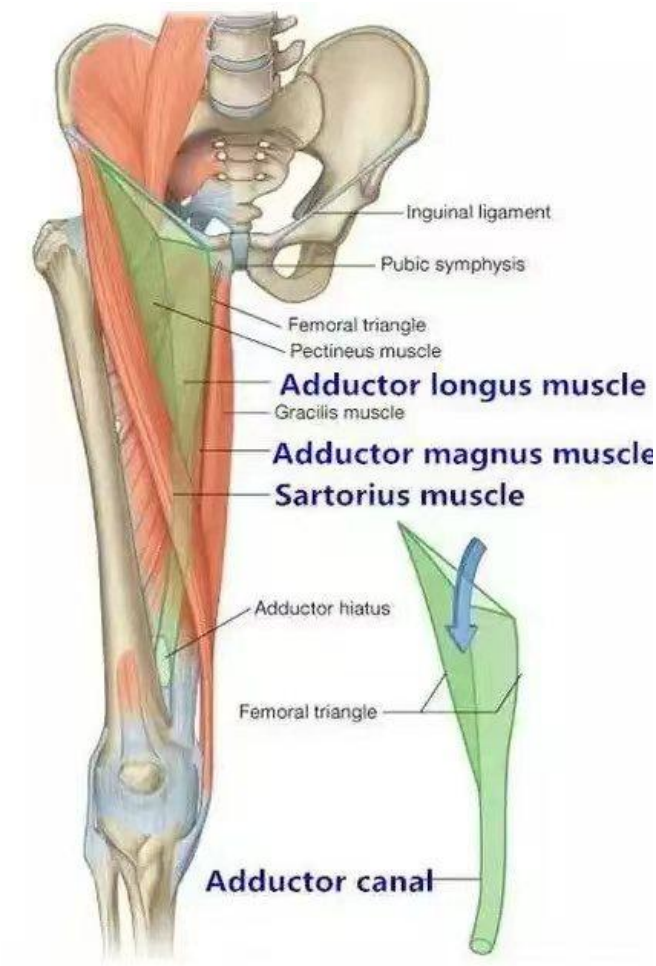
Precautions:

1). As a toxic rescue drug CF for MTX, intravenous drip is usually started 6 hours after MTX injection, once every 6 hours, for 12 times (3 days). At the same time, do a good job in monitoring the blood drug concentration, adjust the drug dosage at any time, and please note that excessive use of CF may counteract the chemotherapeutic effects of MTX.

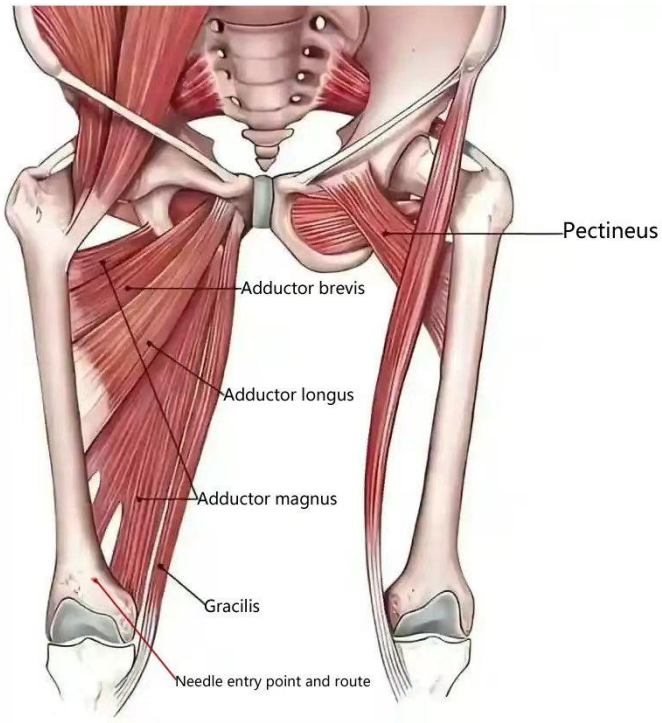
2). Combined autologous leukocyte implantation, it was arranged on the first day, the ninth day and the 21st day. It is also navigated by AI, operated by robots, and slowly pushed by the static pulse injection pump into the osteolytic destruction area of osteosarcoma.

2. The Preparatory Work for Direct Intratumoral Chemotherapy in the Solid Tumor of Osteosarcoma (Zhang, Wang, Chen, et al., 2023; Johnson, Smith, Lee, et al., 2024; Brown, Garcia, Martinez, et al., 2025; Chen, Liu, Zhang, et al., 2025)

1). The high-resolution image data of the patient's bone and tumor area was obtained through DR, CT and MRI, and AI identifies the low-density osteolytic destruction area at the distal metaphysis of right femur, the edge is irregular, and bone cortex of the femoral medial condyle is partially interrupted. **The tumor invades the adductor magnus and the gracilis muscle from the medial and posterior aspects,** forming a lump with unclear boundaries of about 15cm x 16cm, and high-density tumor bones can be seen in the surrounding soft tissue. The tissue structure of the sartorius, adductor longus, adductor brevis and vastus medialis is normal, the saphenous nerve, femoral artery and femoral vein within the adductor canal are normally arranged, the bone structure of the knee joint is intact. The anatomical diagram of the adductor canal is shown below:



Based on the three-dimensional reconstruction model (error <0.1 mm), AI selects the bone cortex above the medial condyle of the femur, where the periosteal reaction is not obvious, as the needle point, simulates the needle angle and needle depth, and formulates the most ideal needle route to reach the target position to ensure that peripheral nerve vessels and healthy tissues are not damaged. Doctors who perform the operation should be familiar with AI positioning navigation and robot operation in advance, and master the established needle entry point, needle entry angle, needle entry depth and the most ideal needle entry route. Please see the picture below:



2). Do a good job in doctor-patient communication and sign the operation

Explain to patients and their families that we are just in the era when AI technology is rising in an all-round way, and AI wisdom is leading mankind to build a highly developed all-intelligent society. Today, we have advanced AI positioning and navigation technology, and the precise and safe operation function of orthopedic robot. In the face of complicated cases such as osteosarcoma, we don't talk about cancer discoloration any more. We have enough confidence and courage to make bold innovations, and uniformly adjust the drug supply method from the traditional intravenous infusion medication mode to static pulse injection pump micro-volume slow push, and by AI positioning and navigation and robot operation, MAP chemotherapy drugs are accurately involved into the osteolytic destruction areas of osteosarcoma, forming high-concentration chemotherapy drugs in the solid tumor, enhancing the direct killing of tumor targets, showing the power and the innovative spirit of direct chemotherapy in the solid tumor of osteosarcoma. At the same time, it also reduces the toxic absorption of human body, reduces the side effects of liver and kidney damage, bone marrow suppression, cardiotoxicity and neurotoxicity, and alleviates chemotherapy-related suffering in patients.

3. The Operation Process of Direct Chemotherapy in the Solid Tumor of Osteosarcoma (Smith, Johnson, & Lee, 2024; Johnson, Gupta, & Lee, 2024; Garcia, Kim, & Nguyen, 2025; Lisacek-Kiosoglous, Powling, Fontalis, Gabr, Mazomenos, & Haddad, 2023)

1). The robot is equipped with an optical positioning system (infrared camera), which can track the position of the patient's skeleton in real time, dynamically align the preoperative three-dimensional model and intraoperative images, and compensate for the small movement of the patient's body

position through the point cloud registration algorithm (such as ICP) to ensure the stability of the intraoperative image.

2). Prepare autologous leukocyte

100 ml of blood was collected from the patient's elbow vein, and entered into the procedure of white blood cell replacement by a blood cell separator. 30 ml of white blood cell components were extracted, divided into 3 bags with 10 ml each, put into a sterile blood collection bag with heparin sodium anticoagulant, and stored in a blood storage refrigerator at 4±2℃. Open the reinfusion pipeline to reinfuse other blood components such as red blood cells into the patient.

3). Chemotherapy drugs are accurately involved into the osteolytic destructive area, and direct chemotherapy is carried out in the solid tumor of osteosarcoma.

A. On the first day, MTX and autologous leukocyte were injected:

Select a cortical bone with minimal periosteal reaction as the needle entry point at the anterior medial aspect of the femoral medial condyle in the right knee joint, routine disinfection and sterile towel, local anesthesia, AI positioning navigation, take a hollow guide needle (diameter 1mm) to penetrate the skin and reach the cortical bone of the femoral medial condyle, control the robotic arm to aim at the osteolytic destruction area, quickly penetrate the cortical bone at one time and reach the subcortical osteolytic destruction area, and the image confirms that the hollow guide needle has not damaged the surrounding nerve and blood vessels, and has not mistakenly entered the knee joint cavity, the saphenous nerve, femoral artery and femoral vein within the adductor canal are normally arranged, then take a No. 9 soft needle with a length of 40mm and slowly enter the osteolytic destruction area along the inner wall of the hollow guide needle. AI controlled the mechanical arm to push the NO.9 soft needle to the target depth with a precision of 0.1 mm, keep the soft needle, withdrew the hollow guide needle, connect the NO.9 soft needle with the static pulse injection pump, turned on the power supply of the static pulse injection pump, and micro-volume slow pushed MTX chemotherapy drugs into the target lesion area, which takes 10 hours. Withdraw the NO.9 soft needle to the superficial layer of the target lesion, and then slowly pushed 10 ml of autologous leukocyte.

Remove the soft needle, and use bone wax to seal the femoral medial condyle puncture site to prevent drug leakage. Apply sterile wound dressing to tightly close the skin puncture site.

B. On the 7th day, according to the above steps, AI positioning and navigation, orthopedic robot operation, static pulse injection pump micro-volume slow push, DDP 94.8mg.

C. on the 9th day, according to the above steps, AI positioning and navigation, orthopedic robot operation, static pulse injection pump micro-volume slow push, ADM 94.8mg and autologous leukocyte 10 ml.

D. On the 21st day, according to the above steps, AI positioning and navigation, orthopedic robot operation, static pulse injection pump micro-volume slow push, DDP 94.8mg and autologous leukocyte 10 ml.

E. every 28 days is a cycle.

4. The Results of Direct Chemotherapy in the Solid Tumor of Osteosarcoma (Petsion, Martino, & Spinos, 2023; Zhou, Wang, Feng, et al., 2022; Wu, Zhou, Gou, et al., 2022)

The patient successfully completed the direct chemotherapy in the solid tumor of osteosarcoma, combined with autologous leukocyte implantation for 4 cycles. During this period, blood routine, liver and kidney function and heart function were monitored, and no obvious liver and kidney damage, bone marrow suppression, cardiotoxicity and neurotoxicity were seen.

Physical examination:

The swelling of the right knee joint was significantly reduced, the local superficial venous filling phenomenon disappeared, the skin temperature was normal, the tenderness relieved, the flexion and extension activity of knee joint increased, the floating patella test was negative, and the peripheral blood vessels were normal.

Imaging evaluation:

X-ray (before chemotherapy):

X-ray film showed osteolytic destruction of the right femur metaphysis, unclear boundary, bone cortex interruption, Codman triangle and solar radiation periosteal reaction.

MRI (before chemotherapy):

1). Bone change: A localized bone destruction area can be seen at the distal metaphysis of the right femur, the boundary is unclear, the T1 weighted image is low, and the T2 weighted image shows an uneven high signal, indicating the formation of tumor bone and bone matrix.

2). Soft tissue invasion: An irregular mass of 15cm x 16cm can be seen in the soft tissue around the tumor, and the signal strength is consistent with that of the tumor body. There is a high signal on the T2 weighted image, and the fat inhibition sequence is clearer, indicating that the tumor invades the adductor magnus, gracilis muscle and adipose tissue.

3). The relationship between joints and vascular nerve bundles: The tumor does not involve the knee joint cavity, and the boundary with the femoral artery, femoral vein and saphenous nerve is clear, and there is no obvious compression or infiltration.

4). Jumping metastasis: MRI did not find a jumping metastasis in other parts of the bone.

X-ray (after chemotherapy):

X-ray film showed that the osteolytic destructive area was reduced and the periosteal reaction was obviously alleviated.

MRI (after chemotherapy):

1). Bone changes: After chemotherapy, the range of the original osteolytic destruction area in the distal right femur has significantly decreased. the boundary is clearer than before. The signal strength of T1 weighted image tends to be uniform, and the high signal area of T2 weighted image is reduced, indicating reduced formation of tumor bone and osteoid matrix, tumor necrosis, and reactive bone hyperplasia.

2). Soft tissue invasion: The surrounding soft tissue mass is significantly reduced to 7.2cm x 8.5cm,

and the signal strength is reduced. The fat inhibition sequence shows that the tumor infiltration range is reduced, and the boundary with the surrounding tissue is clear, suggesting that the tumor is sensitive to chemotherapy and the degree of invasion is reduced.

3). The relationship between joints and vascular nerve bundles: the knee joint cavity is still not affected, the femoral artery, femoral vein, saphenous nerve and tumor boundary are clear, there is no obvious compression or infiltration, and chemotherapy does not cause important structural damage.

4). Jumping metastasis: MRI found no new jumping metastasis in the bone, and chemotherapy effectively controlled the local progression.

Tumor volume change:

After chemotherapy, the tumor volume is 7.2cm x 8.5cm, showing a significant reduction of approximately 50%, creating a clear resection boundary for surgery.

Chemotherapy sensitivity assessment:

Pathological examination after chemotherapy showed that the tumor was sensitive to chemotherapy, and the tumor necrosis rate was over 90%.

Surgical evaluation:

According to the discussion of MDT, the tumor volume was reduced by about 50% by direct chemotherapy in solid tumor before operation, and the tumor was sensitive to chemotherapy, with a tumor necrosis rate of over 90%. The clinical stage has been downstaged from IIA to a potentially resectable status, with clear boundaries and no distant metastasis, which was suitable for surgical resection. Improve lung CT and bone scan before operation to exclude metastasis.

5. Surgical Resection of Osteosarcoma

On November 13, 2025, under epidural anesthesia, the patient underwent the resection of osteosarcoma in the distal metaphysis of the right femur, and the process was smooth.

During the operation, pay attention to the fact that after the osteosarcoma is completely removed, make full use of the artificial ligament to cover the residual bone lesion area, and the edges are tightly sutured to form a postoperative lesion area with a certain capacity space under the artificial ligament, becoming a target position where postoperative chemotherapy drugs can be introduced to implement direct chemotherapy. The surgically removed osteosarcoma tissue specimen was made into a pathological section and the section data was transmitted to the AI system. The pathological diagnosis is "extensive necrosis of tumor tissue after chemotherapy, no surviving tumor cells", which belongs to level IV in Huvos grading, which is a very ideal sign of the effect of chemotherapy.

This result means that preoperative direct chemotherapy in the solid tumor of osteosarcoma has successfully killed the vast majority of tumor cells, which creates a favorable condition for the complete resection of the tumor, and is also an important basis for the follow-up treatment plan (such as continuing the original direct chemotherapy regimen). Adjust the dosage and schedule of MAP regimen, still by AI positioning and navigation, robot operation, static pulse injection pump micro-volume slow

push, accurately intervene MAP chemotherapy drugs into the residual bone lesion area after osteosarcoma resection, combined with autologous leukocyte implantation, and implement direct chemotherapy in the residual bony lesion area for 4-8 cycles after osteosarcoma resection. At the same time, regular laboratory examination, imaging examination and physical examination should be done after operation, and the examination data should be imported into AI system in time to scientifically evaluate the prognosis of the tumor, whether it has recurrence, spread or metastasis.

6. Case Experience

Clinically, more than 90% of malignant bone tumors are solid tumors, such as osteosarcoma, chondrosarcoma, Ewing's sarcoma, chordoma, malignant fibrous histiocytoma, etc. So far, the basic treatment principles for malignant bone tumors have always been surgical treatment combined with adjuvant chemotherapy and radiotherapy. At present, proton radiotherapy makes use of the Bragg peak characteristics of proton beam to concentrate energy on the tumor area, accurately target the tumor and reduce the damage to peripheral nerves, brain stem and spinal cord, especially in the treatment of chordomas of skull base and spine, the targeting characteristics of proton radiotherapy are outstanding. In contrast, the targeting of chemotherapy drugs for malignant tumors is not clear enough. Many chemotherapy drugs enter the human body through intravenous infusion, which destroys and interferes with the growth and division of tumor cells, and also produces toxic effects on normal and rapidly dividing cells of the human body, leading to side effects such as alopecia, nausea and vomiting, liver and kidney damage, bone marrow suppression and decreased immunity. Therefore, advocating the combination of chemotherapy with targeted therapy (Britt B. M. Suelmann & Michiel S. van der Heijden, 2025) (for patients with specific genetic mutations) or immunotherapy (such as PD-1/PD-L1 inhibitors); advocating new drug delivery technologies such as nanoliposome particle wrapping (Yingjie Ren, Ziliang Dong, Han Wu, & Qin Fan, 2025; Li Shenglong & Yu-Ling Mao, 2024), increasing the concentration of chemotherapy drugs, reducing damage to normal tissues, and improving the cure rate of malignant tumors is a strategic direction for the development of modern therapy. Driven by this strategic direction, we conducted the first case of AI positioning navigation, robot operation, static pulse injection pump micro-volume slow push, precise intervention of chemotherapy drugs into osteolytic destruction area at the distal femur metaphysis, combined with autologous leukocyte implantation, to implement direct chemotherapy in the solid tumor of osteosarcoma. It indeed can increase the concentration of chemotherapeutic drugs within tumors by focusing drug delivery to the tumor site, enhancing the direct killing effect on tumor targets while potentially reducing systemic side effects.

Solid tumors in other systems, such as lung cancer, gastric cancer, liver cancer, intestinal cancer, uterine cancer, etc., all grow in important organs of the human body, and the anatomical relationship is complex. Chemotherapy drugs directly intervene in the solid tumors to carry out direct chemotherapy, both in terms of clinical operation and safety, are quite challenging. Please ask all specialists to deeply understand the principle of AI positioning and navigation, master the precise operation skills of robots,

be bold and cautious, be brave in innovation, and carry out direct chemotherapy for the solid tumors of malignant tumors in various specialist fields in a down-to-earth manner. I believe that compared to targeted therapy and nanotechnology, this is a more direct and more precise approach to intratumoral chemotherapy.

The bunkers are most easily destroyed from within; attacking from the outside makes it nearly impossible to breach them.

7. Next Scientific Research Proposal

Malignant bone tumor is a difficult problem in modern medicine. A vast human immune system is surprisingly powerless against a tumor growing within its own body. Humans have not yet been able to fully understand and completely cure cancer with existing medical knowledge and treatment methods. I have requested AI more than once, and the AI system extracts the essence of modern medicine from the vast academic database, pointing out that the occurrence of malignant bone tumors is the result of multiple factors such as gene mutation, abnormal cell proliferation and immune escape (Galluzzi et al., 2024; Yan et al., 2025; Lorenzo Galluzzi team, 2024; Malte Roerden & Stefani Spranger, 2025).

In fact, life is an organism in which immune cells represented by NK cells coexist with cancerous, diseased and senescent cells for a long but limited period of time. During this limited period of time, the immune cells of the human body have always coexisted with cancer cells, lesion cells and aging cells in a dynamic balance of mutual rejection and mutual killing. The cancer cells are created in our bodies every day, we live healthy every day without sick, without cancer, and not easily aging, it should be attributed that the NK cells have a sufficient activity to constantly identify and kill cancerous, diseased and senescent cells in our body at any time, but in this normal process of immune activity, the number and activity of NK cells are gradually consumed.

Although every body will try their best to cooperate with doctors and do everything possible to compensate for the number and activity of NK cells, to improve immunity, in the face of the continuous invasion of cancerous, diseased and senescent cells, NK cells are ultimately a failure. Once the loss of NK cell killing activity is irreparable, it may lead to a serious illness, a cancer or organ failure, in the end, those Grim Reapers who bring the soul of life to see God can be diseased cells or cancer cells or aging cells；those malignant bone tumor cells, taking advantage of the opportunity, might find a breakthrough in bone tissue with weak immune defense and invade it through various mechanisms. For example, the bone tissue microenvironment has a rich vascular network, which facilitates the retention of circulating tumor cells (CTCs), growth factors in the bone marrow (such as TGF-β) can support tumor growth, and the "immune exemption" characteristic formed in the bone tissue microenvironment due to reduced infiltration of immune cells, among other biological immunological factors, may provide favorable conditions for malignant bone tumor cells to colonize in bone tissue. As a result, the heartbreaking thing happened just like that (Roodman, 2019; Pengrong Ouyang, Xijing He, & Feng Xu, 2024; Zhang et al., 2021; Cao et al., n.d.; Leventhal et al., 2022).

In 2023, Cell reported that Israeli scientists used Zman-seq technology to track the dynamic changes of NK cells in glioblastoma animal models, discovering that NK cells lose their anti-tumor activity within 24 hours of entering the tumor. Macrophages, after entering the tumor, are reprogrammed by the tumor within 48 hours to become immunosuppressive cells, further promoting tumor growth. This experiment suggests that the malignancy of tumor cells is indeed formidable, and we must never view it with simplistic thinking. Moreover, it is absolutely impossible to subdue it with just a single instance of immune rejection. Since malignant bone tumors remain a major challenge in modern medicine, we should and must find a specific method that can directly target their core weaknesses to cure them (Kirschenbaum, Xie, Ingelfinger, et al., 2023; Alexander Y. Rudensky & Chrysothemis, 2025; Fred Ramsdell, 2023).

Immune rejection is a process in which the immune system of human body attacks and destroys the graft (allogenic cell, tissue or organ) through specific immune response. Generally speaking, after transplantation, the immune system of receptor can identify the graft antigen and produce a response, and the immune cells in the graft can also identify the recipient's antigen tissue and produce a response.

It can be seen that no matter what type of immune rejection is in clinic, it should occur in the receptor body. All adverse consequences caused by immune rejection, including tissue and organ damage, systemic adverse reactions, and even life-threatening, are unilaterally borne by the receptor. From the conventional logic point of view, this is a natural thing. The immune rejection should have occurred in the receptor body. This is the universal law of immune rejection that everyone is familiar with.

However, if we create a biochemical environment in vitro which is identical to the recipient's peripheral blood, and replace the immune rejection reaction from the recipient's body into the biochemical environment in vitro, so the immune rejection reaction occurring in the specific environment in vitro, compared to the immune rejection reactions commonly seen in the human body, the results are completely different, and it does not cause any harm to the human body. The animal experiment initially suggests that the establishment of in vitro immune rejection reaction of receptor may help human beings to realize transplantation of NK cells from different species (Lin, 2025). This experiment demonstrates that under the specific environmental condition in vitro, immune rejection can show its particularity (Smith, Jane Doe, 2020).

The principle of dialectical relationship between universality and particularity is an important concept in philosophy. It reveals the universal laws and special manifestations of the development of things, and has important methodological and philosophical significance. When observing and dealing with problems, we need to fully grasp this principle to realize the specific unity of the universality and particularity, commonality and individuality of things. The universality and particularity of immune rejection constitute a dialectical unity, which are interdependent, mutually inclusive, and can transform into each other under certain conditions. We should scientifically apply the particularity of immune rejection (John Smith, 2023; Michael Brown, 2021).

According to this dialectical and unified logical thinking, we can select the leukocyte of animals with

exceptionally strong immunity to replace the autologous leukocyte for direct intervention in the solid tumors of malignant bone tumor. Due to the significant differences in MHC between animals and humans, it is possible to create a severe immune rejection response in the closed space of a solid tumor. but the actual host of this immune rejection reaction is not the patient, but the solid tumor of malignant bone tumor. That is to say, the real place of immune rejection reaction created by us is not the patient, but is confined to the spatially enclosed special microenvironment of the solid tumor. Regardless of whether the immune rejection response within solid tumor is initiated by tumor cells, driven by patient immune cells infiltrating the tumor microenvironment, or executed by cytotoxic attacks from immune cells in animal leukocyte targeting tumor cells; and regardless of the final result of the immune rejection reaction, which cell has the upper hand and what is the victory or defeat, the most important thing for us to pay attention to is whether the immune rejection reaction occurs as expected after each animal leukocyte intervenes in the solid tumor, and whether the response is fierce or not? As long as the immune rejection response can occur time and again in the enclosed space of a solid tumor, as an actual host, the solid tumor must unconditionally endure all the destructive impacts of the ongoing immune rejection reaction on the tumor structure, may ultimately lead to the complete collapse of the tumor microenvironment. The tumor cells want to survive, but they probably can't; and even if they want to spread and metastasize, but there's no way out. It fully shows that there is indeed a dialectical unity between the universality and particularity of immune rejection, which are interdependent, mutually inclusive, and can transform into each other under certain conditions. The immune rejection occurring under the condition of confined space in a solid tumor can exhibit a particularity of destroying the tumor microenvironment (Anna Wilson & James Brown, 2022).

Therefore, our research plan is to implement direct chemotherapy in the solid tumor of malignant bone tumor while combining it with animal leukocyte transplantation, fully utilizing the particularity of immune rejection under the condition of confined space in a solid tumor to destroy the tumor microenvironment, thereby providing a new theoretical basis for future clinical treatment of malignant bone tumor.

Of course, this therapeutic approach is best suited for malignant bone tumors in superficial areas of the human body. Once the toxic reactions of immune rejection break through the boundaries of the solid tumor and spread into the patient’s body, immediate expansion drainage or negative pressure drainage can be performed to promptly remove necrotic tissue and secretions caused by the immune rejection reaction.

Finally, I summarize the Key Points of Clinical Practice of our project plan:

1). AI positioning and navigation, robot operation, static pulse injection pump micro-volume slow push, precise intervention of chemotherapy drugs into the bone lesion area for direct chemotherapy administration in the solid tumor of malignant bone tumors.

2). While implementing direct chemotherapy administration in the solid tumor of malignant bone tumors, combined with animal leukocyte transplantation, fully utilizing the particularity of immune

rejection under the condition of confined space in the solid tumor to destroy the tumor microenvironment.

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