

Department of Orthopaedic Surgery

Keishi Marumo, *Professor*
 Hajime Sugiyama, *Professor*
 Shigeru Soshi, *Professor*
 Makoto Kubota, *Associate Professor*
 Mitsuru Saito, *Associate Professor*
 Yoshio Kumagae, *Associate Professor*
 Tonzuka Hisahiro, *Associate Professor*
 Ryo Ikeda, *Assistant Professor*
 Kazuhiro Maeda, *Assistant Professor*
 Chikara Ushiku, *Assistant Professor*
 Jun Udaka, *Assistant Professor*

Takuya Otani, *Professor*
 Takaaki Tanaka, *Professor*
 Hiroki Funasaki, *Professor*
 Mamoru Yoshida, *Associate Professor*
 Hideki Fujii, *Associate Professor*
 Masaaki Chazono, *Associate Professor*
 Soki Kato, *Assistant Professor*
 Tetsuro Nishizawa, *Assistant Professor*
 Tsutomu Kato, *Assistant Professor*
 Teruyuki Miyasaka, *Assistant Professor*

General Summary

Basic Research

Our studies of bone metabolism have been highly acclaimed both in Japan and abroad. Within the research on bone quantity, we reported results of quantitative analysis of advanced glycation end-products (AGEs) in bone tissue and elucidated the harmful effects AGEs on osteoblastic cells.

The research on rheumatoid arthritis has been focused on Wnt proteins expressed in the synovium based on analyses with fibroblastic cell lines and rheumatoid arthritis models. We previously reported that synovial Wnt proteins enhance osteoclastogenesis and promote joint destruction. The present studies address the roles of synovial Wnt proteins in cartilage metabolism.

Clinical Research

Our clinical practice has been divided into 10 subspecialties to cover a wide range of musculoskeletal disorders and has been managed by different specialist teams: knee joint, hip joint, spine, shoulder joint, hand surgery, foot surgery, trauma, osteoporosis, rheumatic diseases, and sports medicine. All teams maintain a high level of expertise and are actively involved in scientific activities.

Research Activities

Treatment of proximal humeral fractures and their sequelae with the Aequalis fracture prosthesis

The present study examined the clinical results of hemiarthroplasty with the Aequalis fracture prosthesis (Tornier, Wright Medical Group) for proximal humeral fracture or its complications. The patients were 1 man and 3 women with a mean age of 69 years. The mean postoperative follow-up period was 8 months. In all patients the pain disappeared soon after the operation, and no complications were noted. In 2 patients younger than 70 years, a good range of motion was obtained with a good tuberosity healing. This prosthesis has a slim shape with potential bone grafting and reduction of tuberosities is relatively easy. As a result, the repair of the rotator cuff function was obtained, which led to a good

result.

The current activities of the hand surgery division

We reported the usefulness of dual energy computed tomography (DECT) for the diagnosis of gouty tophi located in the carpal tunnel. DECT is a CT method wherein a target is imaged with X-rays of two different energies. The technique of using the difference in the attenuation coefficient of each energy enables discrimination of the materials. DECT not only helps with the diagnosis of and surgical planning for atypical tophi but is also extremely useful for postoperative evaluation to determine whether the lesion has been removed. Schwannoma is derived from a peripheral nerve. Its enucleation is surgical. After operation, Neurological deficits appearing after operation remain a clinically challenging issue. We analyzed risk factors of neurological deficits following enucleation. The identified risk factors were the radial nerve origin, proximal nerve origin and 25 mm or more of tumor size of.

Pelvic anchor screw fixation for spinal deformity in adult patients

In corrective surgery for adult spinal deformities, strong fixation with pelvic anchor screws is important. Since 2016, we have been percutaneously inserting 2 sacral-alar-iliac screws on each side with a modified J-probe under X ray fluoroscopy. There were no complications observed (organ/vessel/nerve damage) after surgery. The duration of surgery and intraoperative irradiation could be effectively shortened. While being minimally invasive, the surgery is expected to provide strong and lasting fixation.

Clinical results of a flat-tapered-wedge short stem insertion in primary total hip arthroplasty for hip dysplasia in an Asian population

Cementless femoral reconstruction in patients with hip dysplasia is challenging. We studied postoperative clinical outcomes of primary total hip arthroplasty in 257 hips using flat-tapered-wedge short femoral stems for hip dysplasia in Asian patients (mean postoperative follow-up period 5.3 years). Favorable clinical functional outcomes were obtained, including radiographically confirmed biological fixation with all stems. Regarding complications, split fracture of the femoral calcar region during stem insertion did not occur, and postoperative dislocation occurred only in 1 case (0.4%). The flexibility of the flat-shaped short low-volume stem allows more accurate stem positioning in patients with hip dysplasia. Better and easier positioning might reduce fractures when sufficient and secure fixation is achieved.

The current activities of the knee team

To improve the surgical technique of total knee arthroplasty, the accuracy of a new intraoperative 3D navigation system was assessed by comparison with preoperative 3D CT data. In another study, it was demonstrated through multivariate analysis of postoperative patient data that preoperative anemia and use of sedative hypnotics are main risk factors for postoperative delirium that strongly affects postoperative rehabilitation and recovery time.

The knee team has also used a miniature swine model to demonstrate that a titanium-web

implants improve tendon–bone healing and collagen maturation in reconstructed anterior cruciate ligaments (ACL). A new technique with an originally designed rectangular retrodilator for bone tunnel preparation enabled safe and anatomical reconstructions of the ACL attachment sites.

A study on the pathogenesis of hallux rigidus using CT

There are still many uncertain issues concerning the pathogenesis of hallux rigidus, and we conducted various investigations to clarify some of them. In 2019, we recorded and examined the osteoarthritic changes in hallux rigidus using CT. The CT results showed narrowing of the joint space on the dorsal side of the metatarsophalangeal joint, and location of the proximal phalanx on the plantar side relative to the metatarsal head. This suggested that restricted dorsiflexion and arthritic changes in the metatarsophalangeal joint may be caused by plantar contracture. In our previous review, osteophytes and residual cartilage on the dorsal metatarsal head were observed more dorsally to the cartilage deficit, consistent with the current findings.

Quantitative analysis of AGEs in bone tissue, and elucidation of detrimental effects AGEs on osteoblastic cells

Many reports indicate that accumulation of AGEs in bone collagen deteriorates bone quality. We quantitatively analyzed various AGEs including pentosidine with liquid chromatography mass spectrometry (LC-MS). Analysis of 182 specimens of human cancellous bone dissected during total knee replacement revealed that MG-H1 and CML, AGEs newly determined in our research, were at levels approximately 100–200 times as high as pentosidine but showed similar tendencies of accumulation. A multiple linear regression analysis identified the independent determinants of high AGE levels to be male sex, ageing, low turnover, high HbA1c, and obesity. We also analyzed detrimental effects of AGEs on osteoblasts by incubating MC3T3-E1 cells with glycolaldehyde to induce CML accumulation within cells. The results showed that the accumulation of CML in osteoblasts causes apoptosis, which is mediated by endoplasmic reticulum (ER)-related stress.

Treatment of unstable intertrochanteric femoral fractures using an injectable complex of beta-TCP, hyaluronic acid, and FGF-2

We evaluated effects of an injectable complex of beta-TCP granules, hyaluronate, and FGF-2 on repair of unstable intertrochanteric fractures. We used the complex clinically to treat intertrochanteric fractures of AO classification 31-A2 fractures in 7 patients; intramedullary nails were inserted after injection of the complex. Fracture union occurred in all cases and union of the displaced lesser trochanter to the shaft was obtained in 6 cases by 12 weeks. The complex can facilitate callus formation and may be useful in treatment of other long bone fractures with displaced fragments and its usage may reduce invasiveness of the surgical procedure.

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