Morioka K, Tanikawa C, Ochi K, Daigo Y, Katagiri T, Kawano H, Kawaguchi H, Myoui A, Yoshikawa H, Naka N, Araki N, Kudawara I, Ieguchi M, Nakamura K, Nakamura Y, Matsuda K	Orphan receptor tyrosine kinase ROR2 as a potential therapeutic target for osteosarcoma.	Cancer Sci	100	1227-1233	2009
Matsumoto T, Ohnishi I, Bessho M, Imai K, Ohashi S, Nakamura K	Prediction of vertebral strength under loading conditions occurring in activities of daily living using a computed tomography-based nonlinear finite element method.	Spine	15	1464-1469	2009
Matsudaira K, Yamazaki T, Seichi A, Hoshi K, Hara N, Ogiwara S, Terayama S, Chikuda H, Takeshita K, Nakamura K	Modified fenestration with restorative spinoplasty for lumbar spinal stenosis.	J Neurosurg Spine	10	587-594	2009
Kan A, Ikeda T, Saito T, Yano F, Hojo H, Ogasawara T, Ogata N, Nakamura K, Chung UI, Kawaguchi H	Screening of chondrogenic factors with a real-time fluorescence-monitoring cell line ATDC5-C2ER: identification of sorting nexin 19 as a novel factor.	Arthritis Rheum.	60	3314-3323	2009
Liu G, Iwata K, Ogasawara T, Watanabe J, Fukazawa K, Ishihara K, Asawa Y, Fujihara Y, Chung UI, Moro T, Takatori Y, Takato T, Nakamura K, Kawaguchi H, and Hoshi K	Selection of highly osteogenic and chondrogenic cells from bone marrow stromal cells in biocompatible polymer-coated plates.	J Biomed Mater Res A	92	1273-1282	2009

Ushita M, Saito T, Ikeda T, Yano F, Higashikawa A, Ogata N, Chung UI, Nakamura K, and Kawaguchi H	Transcriptional induction of SOX9 by NF-κB family member RelA in chondrogenic cells.	Osteoarthritis Cartilage	17	1065-1075	2009
Shinoda Y, Kawaguchi H, Higashikawa A, Hirata M, Miura T, Saito T, Nakamura K, Chung UI, and Ogata N	Mechanisms underlying catabolic and anabolic functions of parathyroid hormone on bone by combination of culture systems of mouse cells.	J Cell Biochem	109	755-763	2010
Fukai A, Kawamura N, Saito T, Oshima Y, Ikeda T, Kugimiya F, Higashikawa H, Yano F, Ogata N, Nakamura K, Chung UI, and Kawaguchi H	Akt1 in murine chondrocytes controls cartilage calcification during endochondral ossification under physiologic and pathologic conditions.	Arthritis Rheum	62	826-836	2010
Hojo H, Yano F, Ohba S, Igawa K, Nakajima K, Komiyama Y, Kan A, Ikeda T, Yonezawa T, Woo JT, Takato T, Nakamura K, Kawaguchi H, and Chung UI	Identification of oxytetracycline as a chondrogenic compound using a cell-based screening system.	J Bone Miner Metab			in press
中村耕三	高齢社会におけるロコモティブシンドローム	運動療法と物理療法	20	300-304	2009
中村耕三	膝痛・骨粗鬆症の新常識！ロコモティブシンドローム	ＮＨＫテレビテキスト　きょうの健康	4	50-61	2009
中村耕三	ひざ痛、骨粗しょう症の新常識！ロコモティブシンドローム.	大人の休日倶楽部ジパング	11	32-33	2009
中村耕三	ひざ痛、骨粗しょう症の新常識　ロコモティブシンドローム	大人の休日倶楽部ミドル	11	32-33	2009
中村耕三	足腰の痛みを緩和し骨を強化！寝たきり予防に効果大と医学会注目の片足立ち	壮快	12	112-113	2009

中村耕三	日々のトレーニングで寝たきりを防ぐ　ロコモティブ症候群を防ぐ.	長陽	秋	34-35	2009
中村耕三	ロコモティブシンドローム	全薬 Journal	246		2009
中村耕三	長寿命社会におけるロコモ提唱の意義	THE BONE	24	25-28	2010
中村耕三	【特集　ロコモティブシンドローム】　長寿社会におけるロコモ提唱の意義	THE BONE	24	25-28	2010
中村耕三	ロコモティブシンドローム-予防・治療のための運動支援	臨床スポーツ医学	27	巻頭言	2010
中村耕三	メールｄｅ　Ｑ＆Ａ	BONE CARE	9	8	2010
中村耕三	【特別講演 II】長寿社会での直立二足歩行の危機-ロコモティブシンドローム-	日本リハビリテーション病院・施設協会誌	3		2010
中村耕三	運動器の健康はいつまでも保証されていない（潮流 2010 キーパーソンに聞く　第 18 回ロコモティブシンドローム）	日本医事新報	4476		2010
阿久根徹	変形性関節症・脊椎症の疫学　特集変形性関節症・脊椎症―診断と治療の最前線―　Geriatric Medicine	老年医学	48	315-318	2010
Hagino H, Furukawa K, Fujiwara S, Okano T, Katagiri H, Yamamoto K, Teshima R	Recent trends in the incidence and lifetime risk of hip fracture in Tottori, Japan.	Osteoporos Int	20	543-548	2009
Hagino H, Nakamura T, Fujiwara S, Ooeki M, Okano T, Teshima R	Sequential change in quality of life for patienrs with incident clinical fractures: a prospective study.	Osteoporos Int	20	695-702	2009

Kumamoto K, Nakamura T, Suzuki T, Gorai I, Fujinawa O, Ohta H, Shiraki M, Yoh K, Fujiwara S, Endo N, Matsumoto T	Validation of the Japanese osteoporosis quality of life questionnaire.	J Bone Mineral Metab	28	1-7	2010
Masunari N, Fujiwara S	Impact of antihypertensive drug use on bone mineral density and osteoporotic fracture – from a epidemiological perspective.	Recent Patents on Endocrine, Metabolic & Immune Drug Discovery			2010
藤原佐枝子	骨折の絶対リスクの考え方と評価法	内科	204	428-431	2009
藤原佐枝子	骨粗鬆症の疫学的背景	臨床画像別冊	25	822-827	2009
藤原佐枝子	骨折リスク評価ツールFRAXの日常診療における意義	治療別冊	91	1899-1903	2009
藤原佐枝子	生活習慣と骨密度	成人病と生活習慣病	39	519-523	2009
藤原佐枝子	FRAXによる骨折リスク評価	リウマチ科	41	299-305	2009
藤原佐枝子、細井孝之、五來逸雄	生活習慣の改善と骨粗鬆症の予防に関する調査研究	Osteoporosis Japan	49	665-670	2009
Suzuki, T. and Yoshida, H	Low bone mineral density at femoral neck associated with increased mortality in elderly Japanese women.	Osteoporos Int	21	71-79	2010
Omori G, Onda Y, Shimura M, Hayashi T, Sato T, Koga Y:	The effect of geometry of the tibial polyethylene insert on the tibio-femoral contact kinematics in Advance Medial Pivot total knee arthroplasty	J Orthop Sci	14	754-760	2009
Kobayashi k, Sakamoto M, Tanabe Y, Ariumi A, Sato T, Omori G, Koga Y	Automated image registration foe assessing three-dimensional alignment of entire lower extremity and implant position using bi-plane radiography	J Biomech	42	2818-2822	2009

Tanishi N, Yamagiwa H, Hayami T, Mera H, Koga Y, Omori G, Endo N	Relationship between radiological knee osteoarthritis and biochemical markers of cartilage and bone degradation (urine CTX-2 and NTX-1): the Matsudai Knee Osteoarthritis Survey	J Bone Miner Metab	27	605-612	2009
Tanaka J, Hasegawa T, koya T, Hashiba M, Omori G, Gejyo F, Suzuki E, Arakawa M	Pulmonary function analysis of Japanese athletes: Possibly even more asthmatics in the field	Allergol Int	59	53-57	2010
縄田厚、秋丸舞、岩崎徹治、渡辺博史、古賀良生、大森豪、遠藤和男	セッティング式筋力測定・訓練器による膝伸展筋力と筋力発揮パターンの解析	運動・物理療法	19	64-70	2008
小田川健一、小林公一、坂本信、谷藤理、田邊祐治、古賀良生、佐藤卓、大森豪	1方向X線像を用いた骨の2D-3Dイメージレジストレーション精度	臨床バイオメカニクス	30	457-461	2009
木村太郎、西野勝敏、大森豪、田邊祐治、坂本信、小林公一、古賀良生	モーションキャプチャーシステムを用いた大腿脛骨関節の3次元運動推定法の開発−3次元下肢アライメント評価システムの3次元運動解析への応用	臨床バイオメカニクス	30	487-492	2009
石谷周一、織田広司、林豊彦、大森豪、渡辺聡、佐藤卓、古賀良生	3次元骨モデルの鏡視画像への重ね併せシステム―水中におけるカメラ校正および切断肢を用いた精度評価	臨床バイオメカニクス	30	509-612	2009
織田広司、石谷周一、林豊彦、大森豪、渡辺聡、谷藤理、佐藤卓、古賀良生	3次元骨モデルの鏡視画像への重ね合わせ表示システム―骨輪郭の半自動抽出法を用いた2D-3D レジストレーション	臨床バイオメカニクス	30	501-508	2009

大森豪	整形外科領域におけるコンピュータ支援手術について	新潟工学振興会広報	17	6−7	2009
笹川圭右、石谷周一、坂本信、小林公一、林豊彦、田邊祐治、佐藤卓、古賀良生、大森豪	MRI モデルの 3 次元下肢アライメントシステムへの応用	臨床バイオメカニクス	30	479-488	2009
西野勝敏、大森豪、木村太郎、田邊祐治、古賀良生	ダイナミック動作における前十字靭帯損傷用装具の制動効果	臨床バイオメカニクス	30	413-418	2009
Naito Y, Hasegawa M, Sudo A, Uchida A.	Late small intestine perforation after cementless total hip arthroplasty.	Hip Int	19 (4)	399-341	2009
Okamura N, Hasegawa M, Nakoshi Y, Iino T, Sudo A, Imanaka-Yoshida K, Yoshida T, Uchida A.	Deficiency of tenascin-C delays articular cartilage repair in mice.	Osteoarthritis Cartilage			2009 [Equb ahead of print]
Araki K, Wakabayashi H, Shintani K, Morikawa J, Matsumine A, Kusuzaki K, Sudo A, Uchida A.	Decorin suppresses bone metastasis in a breast cancer cell line.	Oncology	77 (2)	92-99	2009
Hasegawa M, Kawamura G, Wakabayashi H, Sudo A, Uchida A.	Changes to patellar blood flow after minimally invasive total knee arthroplasty.	Knee Surg Sports Traumatol Arthrosc	17 (10)	1195-1198	2009
Sudo A, Wada H, Nobori T, Yamada N, Ito M, Niimi R, Hasegawa M, Suzuki K,Uchida A.	Cut-off values of D-dimer and soluble fibrin for prediction of deep vein thrombosis after orthopaedic surgery.	Int J Hematol	89 (5)	572-576	2009
Araki K, Sudo A, Hasegawa M, Uchida A.	Devastating ochronotic arthropathy with successful bilateral hip and knee arthroplasties.	J Clin Rheumatol	15 (3)	138-140	2009

Hasegawa M, Nakoshi Y, Iino T, Sudo A, Segawa T, Maeda M, Yoshida T, Uchida A.	Thrombin-cleaved osteopontin in synovial fluid of subjects with rheumatoid arthritis.	J Rheumatol	36 (2)	240-245	2009
Wakabayashi T, Matsumine A, Nakazora S, Hasegawa M, Iino T, Ota H, Sonoda H, Sudo A, Uchida A.	Fibulin-3 negatively regulates chondrocyte differentiation.	Biochem Biophys Res Commun	391 (1)	1116-1121	2010
Niimi R, Hasegawa M, Sudo A, Shi D, Yamada T, Uchida A.	Evaluation of soluble fibrin and D-dimer in the diagnosis of postoperative deep vein thrombosis.	Biomarkers	15 (2)	149-157	2010
山口敏郎、長谷川正裕、須藤啓広、内田淳正	下肢人工関節置換術後にフォンダパリヌクスを用いた深部静脈血栓症の発生率と発生時期の検討	日本人工関節学会誌	39	458-459	2009
須藤啓広、長谷川正裕、若林弘樹、新美塁、内田淳正	臀筋内脱臼性股関節症に対して大腿骨近位部短縮骨切り術を併用したセメントレス人工股関節置換術	日本人工関節学会誌	39	416-417	2009
長谷川正裕、須藤啓広、内田淳正	32mm径骨頭を用いた人工股関節のクロスリンクポリエチレン摩耗	日本人工関節学会誌	39	348-349	2009
今西隆夫、長谷川正裕、須藤啓広、内田淳正	Metal on metal人工股関節置換術後1年までの血清中金属イオン濃度	日本人工関節学会誌	39	120-121	2009
長谷川正裕、若林弘樹、西村明展、須藤啓広、内田淳正	ナビゲーションを用いた最小侵襲人工膝関節置換術	日本人工関節学会誌	39	36-37	2009

渥美覚、須藤啓広、加藤公、福田亜紀、藤澤幸三、内田淳正	Candida glabrataによる人工骨頭置換術後感染の1例	中部日本整形外科災害外科学会雑誌	52 (6)	1387-1388	2009
須藤啓広、長谷川正裕、新美塁、山口敏郎、内田淳正	人工股関節置換術後DVTに対するフォンダパリヌクスの効果と安全性	Hip Joint	35	527-530	2009
山口敏郎、長谷川正裕、須藤啓広、内田淳正、山川徹、細井哲	大腿骨頸部骨折に対する骨接合術後の合併症についての検討	Hip Joint	35	454-457	2009
長谷川正裕、須藤啓広、内田淳正	セラミック破損に対する人工股関節再置換術の術式と成績	Hip Joint	35	137-140	2009
須藤啓広、長谷川正裕、新美塁、山口敏郎、内田淳正	人工股関節再置換術におけるカップの高位設置が患者のQOLに与える影響	Hip Joint	35	131-133	2009
長谷川正裕、須藤啓広、内田淳正	ジルコニア骨頭を用いたTHAのポリエチレン摩耗	中部日本整形外科災害外科学会雑誌	52 (5)	1201-1202	2009
横山弘和、辻井雅也、西村明展、平田仁、須藤啓広、内田淳正	鏡視下手術が有効であった手根中央関節滑膜インピンジメントの1例	中部日本整形外科災害外科学会雑誌	52 (5)	1159-1160	2009
若林弘樹、須藤啓広、長谷川正裕、内田淳正	関節リウマチ高齢患者におけるタクロリムスの効果	整形外科	60 (12)	1249-1252	2009
三枝ふみの、池田雄三、須藤啓広、内田淳正	大腿骨近位部骨折患者の受傷前における骨粗鬆症治療薬の処方に関する実態調査について	Osteoporosis Japan	17 (3)	508-510	2009

長谷川正裕、若林弘樹、須藤啓広、内田淳正	Mini-midvastus IncisionによるMIS TKA　皮切長10cm以上と10cm未満の比較	日本関節病学会誌	28 (1)	87-91	2009
若林弘樹、須藤啓広、長谷川正裕、西岡久寿樹、内田淳正	関節リウマチにおけるエタネルセプトの有効性　インフリキシマブからの切り替え症例との比較	日本関節病学会誌	28 (1)	15-20	2009
長谷川正裕、若林弘樹、須藤啓広、内田淳正	イメージフリーナビゲーションを用いたMIS TKAの臨床評価	中部日本整形外科災害外科学会雑誌	52 (1)	83-84	2009
長谷川正裕、須藤啓広、内田淳正	大腿骨頭表面置換術後の再置換例	中部日本整形外科災害外科学会雑誌	52 (1)	25-26	2009
村木優一、國分直樹、岩本卓也、川瀬亮介、須藤啓広、内田淳正、奥田真弘	ハイドロキシアパタイトブロック充填により骨髄内投与したミカファンギンの体内動態および臨床効果の評価	症例報告 TDM研究	26 (2)	79-83	2009
長谷川正裕、施徳全、新美墨、須藤啓広、内田淳正	人工膝関節置換術後DVTに対するフォンダパリヌクスの予防および治療効果	膝	33 (1)	59-63	2009
Matsumoto M, Watanabe K, Tsuji T, Ishii K, Takaishi H, Nakamura M, Toyama Y, Chiba K, Michikawa T, Nishiwaki Y.	Nocturnal leg cramps: a common complaint in patients with lumbar spinal canal stenosis.	Spine (Phila Pa 1976)	34 (5)	E189- 194	2009
Michikawa T, Nishiwaki Y, Takeba- yashi T, Toyama Y.	One-leg standing test for elderly populations.	J Orthop Sci	14 (5)	675-685	2009

Nakagawa, Y Yoshida M, Yamada H, Minamide A, Kawai M, Maio K：	Clinical outcomes of microendoscopic posterior lumbar decompressive surgery for spinal stenosis patienrts –minimum two years follow-up of 265 cases-	J Jpn Soc Spine Surg Rel Res	20 (3)	766-769	2009
Nomura K, Yoshida M, Kawai,M, Maio K, Nakao S:	Microendoscopic discectomy as a minimally invasive surgery for lumbar disc herniation: technical training and learning curve.	日本脊椎脊髄病学会雑誌	20 (3)	649-652	2009
Minamide A, Yoshida M, Yamada H, Nakagawa Y, Maio K, Kawai M, Iwasaki H	Clinical outcomes of microendoscopic decompression surgery for cervical myelopathy.	Eur Spine J			2009 [Epub ahead of print]
吉田宗人	腰部脊柱管狭窄症に対する黄色靱帯正中スプリット切除法	整形・災害外科	52 (6)	774-776	2009
吉田宗人、河合将紀、左海伸夫、野村和教、中尾慎一、貴志真也	腰椎疾患(椎間板ヘルニア)患者をいかに早期にスポーツ復帰させるか？腰部椎間板ヘルニアに対する内視鏡下手術　スポーツ選手の早期復帰への取り組み	日本整形外科スポーツ医学会雑誌	29 (4)	230	2009
山田宏、吉田宗人、南出晃人、中川幸洋、河合将紀、岩崎博、遠藤徹、延與良夫、中尾慎一	いわゆる Far-out syndrome（腰仙椎移行部の椎間孔外狭窄）の臨床所見	臨床整形外科	44 (6)	593-598	2009

山田宏、吉田宗人、南出晃人、中川幸洋、河合将紀、岩崎博、遠藤徹、安藤宗治、麻殖生和博、延與良夫、中尾慎一	腰仙椎移行部の椎間孔外狭窄症に対する後方侵入脊椎内視鏡手術の治療成績	臨床整形外科	44 (10)	1039-1047	2009
山田宏、吉田宗人、南出晃人、中川幸洋、河合将紀、岩崎博	脊椎内視鏡を用いた腰椎椎間孔外狭窄症に対する低侵襲手術	中部整災誌	52	873-874	2009
南出晃人、吉田宗人、山田宏、中川幸洋、河合将紀、岩崎博	頸髄症患者に対する内視鏡下頸椎後方除圧術の現状と臨床成績	中部整災誌	52 (5)	1259-1260	2009
南出晃人、吉田宗人、山田宏、中川幸洋、河合将紀、岩崎博	頸髄症に対する内視鏡下後方除圧術の臨床成績	臨整外	44 (11)	1125-1131	2009
中川幸洋、吉田宗人、川上守、安藤宗治、山田宏、南出晃人、麻殖生和博、河合将紀、岩崎博、延與良夫、岡田基宏、遠藤徹、中尾慎一	腰椎後方内視鏡手術における閉鎖式ドレーン留置についての前向き調査	臨整外	44	1269-1274	2009
中川幸洋、吉田宗人、山田宏、橋爪洋、南出晃人、河合将紀	後方脊椎内視鏡手術における超音波骨メスの使用経験	脊椎脊髄手術手技	11 (1)	40-43	2009
中川幸洋、吉田宗人、山田宏、橋爪洋、南出晃人、河合将紀	頚椎症性神経根症に対する内視鏡下椎間孔拡大術　—短期成績の向上と低侵襲化のための工夫—	中部整災誌	52	493-494	2009

中川幸洋、吉田宗人、山田宏、橋爪洋、南出晃人、河合将紀	腰部脊柱管狭窄症に対する後方内視鏡下除圧術　–単椎間除圧例と多椎間除圧例についての比較検討-	中部整災誌	52	877-878	2009
中川幸洋、吉田宗人、山田宏、橋爪洋、南出晃人、河合将紀、岩崎博、筒井俊二、遠藤徹、木岡雅彦	脊椎内視鏡手術後の術後せん妄発生について	日本脊髄障害医学会誌	22 (1)	110-111	2009
西秀人、橋爪洋、吉田宗人	リウマチ頚椎病変に発生した非骨傷性中心性頚髄不全損傷の 1 例	日本脊髄障害医学会誌	22 (1)	34-35	2009
岩崎博、吉田宗人、山田宏、安藤宗治、遠藤徹、中尾慎一	特集：腰椎外側部神経障害の診断と治療 Far-out syndrome の診断法	整・災外	52 (8)	1081-1087	2009
岩崎博、山田宏、吉田宗人	整形トピックス　腰椎椎間孔外狭窄病変に対する新しい電気生理学的診断法の試み	整形外科	60 (2)	130	2009
岩崎博、山田宏、遠藤徹、南出晃人、中川幸洋、吉田宗人	肥満患者における脊椎内視鏡下手術の有用性	整形外科	60 (3)	251-253	2009
岩崎博、吉田宗人、山田宏、延與良夫、南出晃人、中川幸洋	手術手技　私のくふう　腰椎椎間孔内狭窄に対する内視鏡下椎間孔拡大術	臨床整形外科	44 (11)	1107-1114	2009
岩崎博、遠藤徹、中尾慎一、河合将紀、中川幸洋、南出晃人、山田宏、吉田宗人	電気生理学的手法を用いた腰椎椎間孔外狭窄病変の新しい診断法	脊髄機能診断学	30 (1)	125-128	2009

岩崎博、山田宏、吉田宗人、南出晃人、中川幸洋、河合将紀	腰椎椎間孔内狭窄に対する内視鏡下後方除圧術の経験.	中部日本整形外科災害外科学会雑誌	52 (3)	577-578	2009
岩崎博、吉田宗人、山田宏、遠藤徹、橋爪洋、南出晃人	新しい電気生理学的評価法による腰椎椎間孔外狭窄の診断	中部日本整形外科災害外科学会雑誌	52 (5):	1233-1234	2009
高見正成、吉田宗人、山田宏、南出晃人、中川幸洋、安藤宗治	Posterior expansive cervico-thoracic laminoplasty で症状悪化を来した頚胸椎連続型後縦靭帯骨化例の検討	中部日本整形外科災害外科学会雑誌	52 (1)	131-132	2009
吉田宗人	内視鏡下腰椎椎間板ヘルニア摘出術	脊椎脊髄ジャーナル	22 (11)	1211-1215	2009
山田宏、吉田宗人、南出晃人、中川幸洋、河合将紀、岩崎博	いわゆる Far-out syndrome に対する脊椎内視鏡下後方除圧術	整形・災害外科	52 (9)	1089-1097	2009
山田宏、吉田宗人	透析性脊椎症手術例の周術期管理と合併症対策	脊椎脊髄ジャーナル	22 (9)	1049-1053	2009
南出晃人、吉田宗人	Failed back surgery の原因と再手術手技 -腰椎椎間板ヘルニアの再手術の原因と revision 手技	脊椎脊髄	22 (7)	826-833	2009
中川幸洋、吉田宗人	脊椎内視鏡手術における背筋にやさしい工夫	整形外科最小侵襲ジャーナル	53	9-13	2009
野村和教、吉田宗人	腰椎椎間板ヘルニアに対する内視鏡下椎間板摘出術（MED 法）.	整形外科看護	14 (2)	1185-1192	2009

Wakao N, Harada A, Matsui Y, Takemura M, Shimokata H, Mizuno M, Ito M, Matsuyama Y, Ishiguro N	The effect of impact direction on the fracture load of osteoporotic proximal femurs.	Med Eng Phys			in press
安藤富士子、西田裕紀子、下方浩史	認知機能の加齢変化－国立長寿医療センター研究所・老化に関する長期縦断疫学研究（NILS-LSA）より	アンチエイジング			印刷中
下方浩史、安藤富士子	サプリメントの有効性の疫学研究	公衆衛生	73 (1)	25-30	2009

Ⅳ．研究成果の刊行物・別刷

J Bone Miner Metab
DOI 10.1007/s00774-009-0080-8

ORIGINAL ARTICLE

Prevalence of knee osteoarthritis, lumbar spondylosis, and osteoporosis in Japanese men and women: the research on osteoarthritis/osteoporosis against disability study

Noriko Yoshimura · Shigeyuki Muraki · Hiroyuki Oka · Akihiko Mabuchi · Yoshio En-Yo · Munehito Yoshida · Akihiko Saika · Hideyo Yoshida · Takao Suzuki · Seizo Yamamoto · Hideaki Ishibashi · Hiroshi Kawaguchi · Kozo Nakamura · Toru Akune

Received: 8 September 2008 / Accepted: 10 March 2009

Abstract Musculoskeletal diseases, especially osteoarthritis (OA) and osteoporosis (OP), impair activities of daily life (ADL) and quality of life (QOL) in the elderly. Although preventive strategies for these diseases are urgently required in an aging society, epidemiological data on these diseases are scant. To clarify the prevalence of knee osteoarthritis (KOA), lumbar spondylosis (LS), and osteoporosis (OP) in Japan, and estimate the number of people with these diseases, we started a large-scale population-based cohort study entitled research on osteoarthritis/osteoporosis against disability (ROAD) in 2005. This study involved the collection of clinical information from three cohorts composed of participants located in urban, mountainous, and coastal areas. KOA and LS were radiographically defined as a grade of ≥2 by the Kellgren–Lawrence scale; OP was defined by the criteria of the Japanese Society for Bone and Mineral Research. The 3,040 participants in total were divided into six groups based on their age: ≤39, 40–49, 50–59, 60–69, 70–79, and ≥80 years. The prevalence of KOA in the age groups ≤39, 40–49, 50–59, 60–69, 70–79, and ≥80 years 0, 9.1, 24.3, 35.2, 48.2, and 51.6%, respectively, in men, and the prevalence in women of the same age groups was 3.2, 11.4, 30.3, 57.1, 71.9, and 80.7%, respectively. With respect to the age groups, the prevalence of LS was 14.3, 45.5, 72.9, 74.6, 85.3, and 90.1% in men, and 9.7, 28.6, 41.7, 55.4, 75.1, and 78.2% in women, respectively. Data of the prevalence of OP at the lumbar spine and femoral neck were also obtained. The estimated number of patients with KOA, LS, and L2–L4 and femoral neck OP in Japan was approximately 25, 38, 6.4, and 11 million, respectively. In summary, we estimated the prevalence of OA and OP, and the number of people affected with these diseases in Japan. The ROAD study will elucidate epidemiological evidence concerning determinants of bone and joint disease.

Keywords Epidemiology · Prevalence · Establishment of population-based cohort · Osteoarthritis · Osteoporosis

N. Yoshimura (✉) · H. Oka
Department of Joint Disease Research, 22nd Century Medical and Research Center, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8655, Japan
e-mail: yoshimuran-ort@h.u-tokyo.ac.jp

S. Muraki · T. Akune
Department of Clinical Motor System Medicine, 22nd Century Medical and Research Center, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

A. Mabuchi
Department of Human Genetics, Graduate School of International Health, The University of Tokyo, Tokyo, Japan

Y. En-Yo · M. Yoshida
Department of Orthopaedic Surgery, Wakayama Medical University School of Medicine, Wakayama, Japan

A. Saika
Saika Clinic, Wakayama, Japan

H. Yoshida · T. Suzuki · S. Yamamoto · H. Ishibashi
Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

H. Kawaguchi · K. Nakamura
Department of Orthopaedic Surgery, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan

Introduction

Osteoarthritis (OA) and osteoporosis (OP) are major public health problems in the elderly that affect their

Published online: 01 July 2009

activities of daily life (ADL) and quality of life (QOL), leading to increased morbidity and mortality. The number of patients with OA increases with the age of the population. According to the recent National Livelihood Survey of the Ministry of Health, Labour and Welfare in Japan, OA is ranked fourth, and falls and osteoporotic fractures are ranked fifth, among the diseases causing disabilities that subsequently require support for activities related to daily living [1]. The authors of the present study as well as other authors have reported increased mortality following osteoporotic fractures at the hip and other sites [2, 3].

Because of the increasing proportion of the aging population in Japan, there is an urgent need for a comprehensive and evidence-based prevention strategy for musculoskeletal diseases, including OA and OP. However, few prospective longitudinal studies have been undertaken, and little information is available regarding the prevalence and incidence of OA and lumbar spondylosis (LS), as well as pain and disability, in the Japanese population [4–7]. Only the estimated number of patients with knee osteoarthritis (KOA) and LS is not known.

More population-based prospective studies have been performed for OP than for OA [8–12]. Japanese guidelines for the prevention and treatment of OP, on the basis of evidence obtained from studies conducted with Japanese subjects, were published in 2006 [13]; however, many epidemiological indices of OP still remain to be clarified. For instance, there is insufficient evidence regarding the risks relating to the incidence of OP, osteoporotic vertebral fractures, and bone loss. Further, data on the number of patients with OP were last reported in 1999 [14], thus necessitating an analysis based on the current prevalence of OP. It is difficult to design rational clinical and public health approaches for the diagnosis, evaluation, and prevention of OA and OP without such epidemiological data.

The research on osteoarthritis/osteoporosis against disability (ROAD) study is a prospective cohort study that aims to elucidate the environmental and genetic background for bone and joint diseases, especially OA and OP; it is designed to examine the extent to which risk factors for these diseases are related to clinical features, laboratory and radiographic findings, bone mass and bone geometry, lifestyle, nutritional factors, anthropometric and neuromuscular measures, and fall propensity, as well as to determine how these diseases affect ADL and QOL in Japanese men and women.

Here, the prevalence of KOA, LS, and OP is clarified, and the number of patients with these diseases in Japan is estimated by analyzing the baseline data of the ROAD study.

Participants and methods

Study population

A complete baseline database was established that included the clinical and genomic information of 3,040 inhabitants (1,061 men and 1,979 women) with a mean age of 70.3 [standard deviation (SD), 11.0] years, 71.0 (SD, 10.7) years in men and 69.9 (SD, 11.2) years in women. These subjects were recruited from listings of resident registrations in three communities with different characteristics: an urban region in Itabashi, Tokyo; a mountainous region in Hidakagawa, Wakayama; and a coastal region in Taiji, Wakayama (Fig. 1).

Itabashi Ward, an urban community located in the eastern Tokyo (area, 32 km^2) has a population of 529,400, and the proportion of aged people in this region, defined as the number of residents who were 65 years old or older (≥65) divided by the total population, is 19.1%. The percentage of the population having jobs in primary industries (agriculture, forestry, fishing, or mining), secondary industries (manufacturing and construction), and in tertiary industries (service industries) is 0.1, 25, and 75%, respectively [15]. Hidakagawa Town, a rural mountainous community located in the center of Wakayama (area, 330 km^2), has a population of 11,300 and 30.5% of the inhabitants are ≥65 years old. The percentages of workers with jobs in the primary, secondary, and tertiary industries are 29, 24 and 47%, respectively [15]. Taiji Town, a rural coastal community located south of Wakayama (area, 6 km^2), has a population of 3,500, with 34.9% of inhabitants ≥65 years old; the percentages of workers with jobs in primary, secondary, and tertiary industries are 13, 18, and 69%, respectively [15].

Residents of these three urban, mountainous, and coastal regions were recruited from the resident-registration lists of the relevant regions. Participants in the urban region, aged ≥60 years, were recruited from among those of a randomly selected cohort study from the previously established Itabashi Ward resident registration database [16]. The

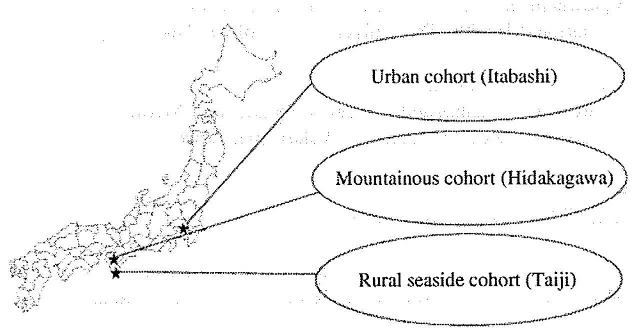

Fig. 1 Location of the three cohorts with different characteristics in Japan

response rate was 75.6%. Participants in the mountainous and coastal regions, aged ≥40 years, were recruited from listings of resident registration. However, those inhabitants aged <60 years in the urban area and <40 years in the mountainous and coastal areas who were interested in participating in the study were invited to be examined.

In addition to residence in the communities as outlined above, the inclusion criteria were as follows: the patient had to (1) be able to walk to the clinic at which the survey was performed, (2) provide self-reported data, and (3) understand and sign an informed consent form. No other exclusion criteria were used.

Participants were enrolled and the initial baseline examinations were completed over a 1.5-year period from October 2005 through March 2007. All participants provided written informed consent. The study was conducted with the approval of the ethics committees of the University of Tokyo (nos. 1264 and 1326) and the Tokyo Metropolitan Institute of Gerontology (no. 5). Careful consideration was given to ensure a safe experience for participants during their examinations and any other study procedures.

Radiographic assessment

Plain radiographs of the lumbar spine in the anteroposterior and lateral views and bilateral knees in the anteroposterior view with weight-bearing and foot map positioning were obtained. The severity of radiographic OA was determined according to Kellgren–Lawrence (KL) grading as follows [17]: KL0, normal; KL1, slight osteophytes; KL2, definite osteophytes; KL3, joint or intervertebral space narrowing with large osteophytes; KL4, bone sclerosis, joint or intervertebral space narrowing, and large osteophytes. In the ROAD study, participants were classified into KL3 if they had joint or intervertebral space narrowing without large osteophytes. Radiographs at each site, i.e., the knees, hips, and vertebrae, were examined by a single, experienced orthopaedic surgeon (S.M.), who was masked regarding participants' clinical status. If at least one knee joint was graded as KL2 or higher, the participant was diagnosed with radiographic KOA. Similarly, if at least one intervertebral level of the lumbar spine was graded as KL2 or higher, the participant was diagnosed with radiographic LS.

Bone mineral density measurement

In the mountainous and coastal areas, bone mineral density (BMD) was measured at the lumbar spine (L2–L4) and the proximal femur using dual-energy X-ray absorptiometry (DXA) (Hologic Discovery; Hologic, Waltham, MA, USA) at baseline.

To control quality, the same DXA equipment was used and the same spine phantom was scanned daily to monitor the machine's performance in study populations at different regions. The BMD of the phantom was adjusted to 1.032 ± 0.016 g/cm^2 (±1.5%) during all examinations. In addition, the same physician (N.Y.) examined all participants to prevent observer variability. Intraobserver variability using the Lunar DPX in vitro and in vivo had been measured by the same physician (N.Y.) for another study [18]. Coefficient of variance (CV) for L2–L4 in vitro was 0.35%, and CVs for L2–L4, the proximal femur, Ward's triangle, and the trochanter examined in vivo in five male volunteers were 0.61–0.90, 1.02–2.57, 1.97–5.45, and 1.77–4.17%, respectively.

OP was defined as a BMD of less than 70% of peak bone mass according to the criteria of the Japanese Society for Bone and Mineral Research [19]. OP was defined by BMD < 0.708 g/cm^2 at the lumbar spine in the case of both men and women, and by BMD < 0.604 g/cm^2 at the femoral neck for men and <0.551 g/cm^2 for women, respectively.

Statistical analysis

All statistical analyses were performed using STATA statistical software (STATA, College Station, TX, USA). Differences in proportion were compared by the chi-square test. Differences of continuous values were tested for significance using analysis of variance (ANOVA) for comparisons among multiple groups and Scheffe's least significant difference (LSD) test for pairs of groups. Significant items were selected, and multiple regression and logistic regression analyses were performed by adjusting suitable variables.

Results

Table 1 shows selected characteristics of the participants in the three regions including age, height, weight, body mass index (BMI), and BMD. The percentage of participants >60 years of age was 99.8, 84.3, and 54.7% in the urban, mountainous, and seacoast regions, respectively. Two-thirds of the 3,040 participants were women, and the mean age of female participants was 1 year less than that of the male participants.

Regarding the gender differences in the anthropometric measurements, height and weight were significantly lower in women than in men, but no significant difference in BMI was noted between the genders. All values of BMD at L2–L4, femoral neck, and total hip were significantly higher in men than in women ($P < 0.001$).

Table 1 Age–sex distribution and mean values (standard deviation) of selected characteristics of the participants

Age strata (years)	Men				Women			
	Total	Urban	Mountainous	Seacoast	Total	Urban	Mountainous	Seacoast
–39	14	0	2	12	31	0	7	24
40–49	44	0	7	37	105	0	17	88
50–59	107	0	36	71	211	2	67	142
60–69	168	11	93	64	385	60	183	142
70–79	535	315	150	70	913	594	196	123
80–	193	139	31	23	334	229	75	30
Total	1,061	465	319	277	1,979	885	545	549
Age (years)	71.0 (10.7)	77.2 (4.3)	69.5 (9.1)	62.6 (13.2)	69.9 (11.2)	76.3 (5.0)	68.6 (10.4)	60.8 (12.5)
Height (cm)	162.5 (6.7)	161.3 (5.9)	161.4 (6.9)	165.8 (6.8)	149.8 (6.5)	148.5 (5.6)	148.2 (6.7)	153.2 (6.2)
Weight (kg)	61.3 (10.0)	60.0 (8.5)	60.0 (10.2)	64.8 (11.0)	51.5 (8,6)	50.8 (8.3)	50.5 (8.6)	53.5 (8.8)
BMI (kg/m^2)	23.1 (3.0)	23.0 (2.8)	23.0 (3.0)	23.5 (3.4)	22.9 (3.5)	23.0 (3.4)	23.0 (3.4)	22.8 (3.6)
BMD (g/cm^2)								
L2–L4	1.05 (0.20)	–	1.04 (0.20)	1.06 (0.21)	0.87 (0.18)	–	0.83 (0.18)	0.91 (0.18)
Femoral neck	0.74 (0.13)	–	0.73 (0.13)	0.76 (0.13)	0.63 (0.12)	–	0.60 (0.12)	0.66 (0.13)
Total hip	0.88 (0.14)	–	0.87 (0.14)	0.90 (0.14)	0.74 (0.14)	–	0.72 (0.13)	0.76 (0.14)

BMI body mass index, *BMD* bone mineral density

Table 2 shows the age-sex distribution for prevalence of radiographic KOA and LS determined by a KL grade ≥2, classified by region. In the overall population, prevalence of radiographic KOA and LS was 54.6% (42.0% in men and 61.5% in women) and 70.2% (80.6% in men and 64.6% in women), respectively, indicating that the prevalence of LS was higher than that of KOA in the overall population, as well as in the respective genders. When the prevalence was compared among the age strata, radiographic KOA and LS tended to be higher with age in both genders (Table 2). Prevalence of radiographic KOA was 0% in men and 3.2% in women in the <40-year age group and 42.6% in men and 62.4% in women in the ≥40-year age group, and the differences were significant ($P < 0.001$). According to gender, the prevalence was significantly higher in women than in men in the overall population ($P < 0.001$). OA in both knees was observed in 43.1% (31.5% in men and 49.4% in women) of all participants. The overall prevalence of radiographic LS across all ages was 80.6% in men and 64.6% in women, which was considerably higher than that of KOA. In contrast to radiographic KOA, the prevalence of this condition was significantly higher in men than in women ($P < 0.001$). Similar to KOA, the prevalence of LS was lower in the <40-year age group than in the ≥40-year age group, with significant differences in both genders ($P < 0.001$). Among all the participants, 42.3% (37.1% in men and 45.1% in women) had both KOA and LS.

The prevalence of KOA and LS classified by region is also shown in Table 2. Regarding the regional differences, the prevalence of KOA was the highest in the mountainous area, followed by the urban area and the seacoast area in both men and women. By contrast, the prevalence of LS was the highest in the urban area, followed by the mountainous area and the seacoast area.

Logistic regression analysis was performed to determine the effect of region, gender, age, and body build on the prevalence of OA in participants ≥60 years of age, using the presence of KOA as an objective variable, and region (seacoast: 0, mountainous: 1), gender (men: 0, women: 1), age, and BMI as explanatory factors. The analysis revealed that the risk for KOA was significantly higher in the mountainous area [odds ratio (OR), 2.7; 95% confidence interval (CI), 2.1–3.6, $P < 0.001$], in women (OR, 3.4; 95% CI, 2.79–4.06; $P < 0.001$), in advanced age (+1 year: OR, 1.09; 95% CI, 1.07–1.11, $P < 0.001$), and in larger body build (+1 BMI: OR, 1.16; 95% CI, 1.13–1.20; $P < 0.001$). By contrast, the risk of LS was reduced in the mountainous area (OR, 0.63; 95% CI, 0.48–0.83; $P < 0.01$) and in women (OR, 0.47; 95% CI, 0.38–0.58; $P < 0.001$). Advanced age and higher BMI were associated with the presence of LS as well as KOA (+1 year: OR, 1.08; 95% CI, 1.06–1.10; $P < 0.001$; +1 BMI: OR, 1.09; 95% CI, 1.05–1.12; $P < 0.001$, respectively).

Table 3 shows the mean values of BMD among residents of mountainous and coastal regions in the ROAD study. Although the mean BMD values of the lumbar spine were no different between men and women in the age group of <40 years, those of the femoral neck and proximal total hip in the same age group were significantly

Table 2 Prevalence (%) of knee osteoarthritis and lumbar spondylosis classified by age, gender, and region

Age strata (years)	Knee osteoarthritis				Lumbar spondylosis			
	Total	Urban	Mountainous	Seacoast	Total	Urban	Mountainous	Seacoast
Men								
–39	0.0	–	0.0	0.0	14.3	–	0.0	16.7
40–49	9.1	–	42.9	2.7	45.5	–	28.6	48.7
50–59	24.3	–	55.6	8.5	72.9	–	75.0	71.8
60–69	35.2	37.5	44.1	21.9	74.6	75.0	69.9	81.3
70–79	48.2	41.3	63.5	45.7	85.3	83.8	85.3	91.4
80–	51.6	45.6	74.2	56.5	90.1	89.9	90.3	91.3
Total	42.0	42.5	57.1	23.8	80.6	85.5	78.4	75.1
Women								
–39	3.2	–	0.0	4.2	9.7	–	0.0	12.5
40–49	11.4	–	29.4	8.0	28.6	–	29.4	28.4
50–59	30.3	50.0	46.3	22.5	41.7	100.0	29.9	46.5
60–69	57.1	49.1	68.3	45.8	55.4	64.3	50.3	58.5
70–79	71.9	69.3	83.2	66.1	75.1	76.1	70.4	32.0
80–	80.7	77.3	91.9	76.9	78.2	79.6	69.3	90.0
Total	61.5***	70.0***	72.1***	37.8***	64.6***	76.3***	56.3***	54.6***

*** Significantly different ($P < 0.001$) from prevalence in men of the same region

higher in men than in women ($P < 0.001$). When the BMD values were compared among age strata, the prevalence of OP tended to be higher with age in both genders; however, the tendency was much greater in women than in men. Multiple regression analysis was performed to determine the effect of region, gender, age, and body build on BMD in the overall population of the mountainous and seacoast areas, using each value of BMD at lumbar spine, femoral neck, and total hip as an objective variable, and region (seacoast: 0, mountainous: 1), gender (men: 0, women: 1), age, and BMI as explanatory factors. The analysis revealed there was no regional difference in the BMD values at L2–L4, femoral neck, and total hip, whereas there were significant differences in gender (beta at L2–L4, femoral neck, and total hip, −0.41, −0.41, and −0.47, respectively, all $P < 0.001$), age (beta at L2–L4, femoral neck, and total hip, −0.28, −0.43, and −0.42, respectively, all $P < 0.001$), and BMI (beta at L2–L4, femoral neck, and total hip, 0.29, 0.33, and 0.37, respectively, all $P < 0.001$).

Table 4 reveals the prevalence of OP at the lumbar spine, the femoral neck, and the total hip among residents of mountainous and coastal regions in the ROAD study. The prevalence of OP in women was six, two, and three-fold higher, respectively, than in men, with a significant difference ($P < 0.001$). Although the prevalence of OP at the lumbar spine was higher for persons in the seacoast area than in the mountainous area, the prevalence at the femoral neck and total hip were higher in the mountainous area than in the seacoast area. In women, the prevalence of OP at the lumbar spine, femoral neck, and total hip were all higher in the mountainous area than in the seacoast area.

Logistic regression analysis was performed to determine the effect of region, gender, age, and body build on the prevalence of OP, using the presence of OP at L2–L4 as an objective variable, and region (seacoast: 0, mountainous: 1), gender (men: 0, women: 1), age, and BMI as explanatory factors. The analysis revealed that the risk for OP at L2–L4 was significantly higher in women (OR, 10.2; 95% CI, 6.07–17.1; $P < 0.001$), in advanced age (+1 year: OR, 1.10; 95% CI, 1.08–1.12; $P < 0.001$), whereas it was significantly lower in larger body build (+1 BMI: OR, 0.74; 95% CI, 0.69–0.79; $P < 0.001$). There was no significant difference in the prevalence of OP at L2–L4 between the mountainous and seacoast area. A similar tendency was shown in the prevalence of OP at the femoral neck and total hip (femoral neck: women versus men, OR, 3.82; 95% CI, 2.77–5.27; $P < 0.001$; +1 year: OR, 1.11; 95% CI, 1.09–1.13; $P < 0.001$; +1 BMI: OR, 0.75; 95% CI, 0.72–0.79; $P < 0.001$; total hip: women versus men, OR, 4.39; 95% CI, 2.88–6.70; $P < 0.001$; +1 year: OR, 1.11; 95% CI, 1.09–1.14; $P < 0.001$; +1 BMI: OR, 0.70; 95% CI, 0.65–0.75; $P < 0.001$).

Discussion

Little epidemiological information is available for musculoskeletal diseases such as OA and OP in Japan. The