この意見と異なったものとなってもコンサルタントが述べたのは「意見」であって，保険診療上の「診断」ではないので責任はありません，という意味の社会に対する免罪符ではありえない．どのような形態をとったにせよ，専門的見地から意見を求められてこれに応じたコンサルタントの判断に対する社会的道義的責任は免れないであろうし，そこに専門家たるもの，コンサルタントたるものの誇りもあるように思われる．専門家として意見を述べたことへの社会への責任は，報酬を得て行ったか否かや，disclaimerが書かれていたか否か等とは直接の関係なく常について回ると肝に銘じておきたい．そしてコンサルタントのそのような困難を，依頼元の病理医も理解しておくべきである．

c. 報酬と費用負担

米国では外部コンサルテーションは原則有料で行われ，コンサルタントが所属する施設の大切な収入源となっている．我が国では一部を除いてコンサルテーションを有料で行うことはほとんど行われていなかった．依頼元の病理医は金銭的な対価ではなく，貴重な症例の未染標本を提供し，コンサルタントの研究ファイルに加えてもらうことによって，専門家としてのコンサルタントの欲求に報いてきた．日本病理学会コンサルテーションシステムでも同様であり，コンサルタント側，あるいは日本病理学会も「一人病理医」を学会として支援するという本来の趣旨に適うよう，事務局への手数料等に使用される3,000円の実費（2009. 3月現在）のみを受け，コンサルタントはすべて無報酬で対応している．これらの経費や手数料は，各依頼元施設が工夫して負担しているようであるが，施設によっては病理医個人が支払っている場合もあると考えられる．しかし外部コンサルテーション全体としてはここ数年コンサルテーションを有料化（1件5,000円程度が多いようである）する施設や専門家も増えてきている．この動向は，病理診断科の標榜が可能になり，病理診断の診療報酬上の取り扱いの進展等の社会状況を背景に，専門性の提供に対する正当な対価を得るのが本来の姿であるとの意識の普及，診療科標榜とあいまって病理にも病院経営への貢献を求められる傾向があること，診断精度を維持するために高価な追加検索（免疫染色，FISH，PCR等を含む）が行われる等の要因が反映されたものと推察できる．別の観点からみれば，コンサルテーションを受けた側に何らかの対価が支払われることにより，遅滞なく，しかも詳細かつ誠意ある意見報告書の作成・提出が促されるであろうという利点も重要なポイントになりうる．コンサルテーションをめぐるこうした費用負担と報酬支払いの功罪は，サービスとしての実績や利便性，質的評価の積み重ねに伴って今後も議論が続くのであろう．

d. 現状の把握—病理学会の役割

米国においてはCollege of American Pathologists（CAP）が調査を行い，自国内の病理診断施設が依頼している外部コンサルテーションの現状やその動向を分析・把握し，かつ誌上報告することが行われている[6]．外部コンサルテーションの利用状況は，各施設の病理診断精度維持に対する取り組み姿勢や，病理医の配置状況等の指標として価値がある．また，依頼元病理医の満足度や共通してかかえる問題点を調査することにより，外部コンサルテーションサービスの質の向上にも一定の役割が期待できよう．残念ながら，我が国においてはこのような活動は皆無といってよい．日本病理学会コンサルテーション委員会があるが，著者の知るかぎり同委員会は学会自らが運営するコンサルテーションシステム維持のための統括的業務以外には機能をもたず，それ以外の運営主体によって行われているコンサルテーションからは頑ななほどに距離をおいており，我が国の病理学会会員を支えているコンサルテーション全体の現状把握にはほとんど興味を示していない．数年前，公的資金による研究班により外部コンサルテーションの現状把握を目的にアンケート調査が行われたのが唯一で，すでにそれ以来5年が経過している[1]．これまで外部コンサルテーションの受け皿として一般の会員を支えるという重要な役割を担ってきた日本病理学会コンサルテーション委員会ではあるが，さまざまな形態や主体で外部コンサルテーションが盛んに行われるようになってきた今日，その果たすべき役割を見直すべき時期にあるのではないかとの私見を著者はもっている．

e. コンサルテーションにかかる患者同意取得，個人情報提供に関する考え方

個人情報提供という側面からは，患者・家族との無用の行き違いを避けるために受診医療機関（すなわちコンサルテーション依頼元）がなすべき配慮として，受診にあたって発生する個人情報を「診療上必要な場合で，他の医療機関医師の意見・助言を求めるため」に利用する場合は個別に同意を得ることを原則としない旨，そのホームページに明示して一般に公開している施設も多い．慎重に対応すべきと考える医療機関にとっては，やや一方的な伝達方法ではあってもこのようなわかりやすい記載で，了解願いたい事項として明示することは意義が大きいであろう．

他方，コンサルテーション依頼を受ける側の対応は不十分な場合が多い．外部委託検体検査のように依頼元施設と受託企業との間で患者個人情報に関する守秘契約がなされる場合と異なり，コンサルタントへの依頼の多くはいまだ所属機関を介さずに個人レベルで行われているのが実情であり，個人情報保護に関してはコンサルタント個人の医師としての守秘義務の遵守のみに期待することとなっていることから，漏洩の危険に対する責任の所在が不明確になりがちである．その点からは依頼元病理医はもちろん，個人情報を受けることになるコンサルタント側においても十分な配慮や防衛策が求められよう．日本病理学会のコンサルテーションガイドラインでは，診断意見書作成に必須でない個人情報をなるべくコンサルタントに伝えないよう依頼元病理医に配慮を求めている．

II. 病理中央診断

臨床研究でしばしば行われる病理中央診断は，各診療施設から病理標本等の提供を受け，当該分野を専門とする病理医がレビューする点において，コンサルテーションと共通点が多い．しかし一方，病理中央診断には精度管理として行われることに起因する決定的な違いもあることを本稿の冒頭で指摘した．

標準的治療の確立をめざす臨床研究では，複数の施設が解析対象症例を持ち寄って，試験的治療法の有効性や安全性等を評価する．研究の主体からみると，厚生労働省等の公的機関からの補助金・助成金や種々の研究費を得て医師である研究者が臨床研究グループを組織して実施するものや，特定の薬剤等について製薬企業の依頼によって行われるもの（いわゆる治験）等がある．昨今，医師主導治験も計画ないし開始されている．この臨床研究では，治療の有効性を正当に評価するため，解析対象として登録される症例には一定の適格規準を満たしていること等，試験遂行に対する徹底した品質管理が求められる．研究実施計画（プロトコール）の作成にあたって，対象とする患者の年齢幅や，全身状態，病理診断，種々の検査値や病期等の疾患・病態はもちろん，治療の内容および実施方法，許容される副作用への対応等，治療効果判定に影響を与えると推定される因子はあらかじめ綿密に検討される．実際の登録や治療の実施に際しても，プロトコールに記載された取り決めが遵守されることが厳しく求められ，臨床研究グループによっては研究参加施設（患者登録施設）を訪問して診療録の監査を行っている．放射線治療施設にあっては，その照射線量のモニタリングを定期的に行う等の精度管理業務が遂行される．いずれも，ともすれば診断・治療の施設間較差に翻弄されかねない多施設共同臨床研究の品質を保証するための努力である．病理診断の施設間較差があるとすれば，当然これも臨床研究の品質保証活動の対象に入ってくる．

患者登録のための適格条件の中にあって，病理診断はその患者に当該治療が行われることが適切であるかどうか（病理学的適格性があるか否か）の最も基本的な判断因子のひとつである．中央病理診断（病理中央診断）central pathology diagnosisは，それぞれの患者登録施設で下された施設病理診断 local (institutional) pathology diagnosisを研究実施者（実際には研究実施者が依頼する当該領域のエキスパートとされる病理医）が一括してレビューし，登録患者の適格性を保証する目的で行われる．具体的にいえば，マントル細胞リンパ腫のみを対象とすべき試験的治療が，濾胞性リンパ腫患者に行われて結果解析されているようなことはないか，といったことを病理標本レビューによって検証する．中央診断の実施方法には，施設病理診断に基づいて症例登録ならびに治療を実施した後，結果解析の段階において診断レビューを行って不適格例を除外するretrospective reviewと，症例登録前に病理診断レビューを行って適格例のみを本登録し当該治療を開始するprospective reviewがありうるが，後者では個々の患者への治療開始が遅れる場合が多いことから，中央診断はほとんどの場合retrospectiveに行われている．

我が国では，よくデザインされ科学性の高い多施設共同臨床研究自体の歴史が浅く，病理中央診断も当然のことながら経験が少ないといえる．公的研究資金による規模の大きい治療研究と密接に関連したものとしては，1988年頃に国立がんセンター・下山らの主導により Lymphoma Clinico-Pathology Panel (LCPP) が組織され，がん専門病院のリンパ腫約500例を8人の病理医でレビューしたのがおそらく病理診断領域でのこの種の活動としては最初，ではなくともかなり初期ではないかと思われる[7]．この後，この活動は日本臨床腫瘍研究グループ（JCOG）に引き継がれ，リンパ腫や乳癌，脳腫瘍，軟部腫瘍等に範囲を広げて実績を増しつつある[8]．また婦人科腫瘍研究グループ（GOG）や，稀少腫瘍の多い小児腫瘍領域でも日本小児白血病

リンパ腫研究グループ(JPLSG)に代表される明確な組織構築をもつ多施設共同臨床研究組織が運営されており，病理中央診断が実施されて研究の質の向上に大きく貢献している[9]．また，個別研究としては消化管腫瘍，前立腺癌や悪性中皮腫，糸球体腎炎等多彩な領域で病理中央診断が臨床研究の一部として実施され，実績をあげている．

臨床研究の規模にもよるが，登録患者の施設病理診断をすべてレビューすること，またその標本やデータを管理することは決して少なくない作業量である．各分野のエキスパートによって行われる病理中央診断は，臨床研究が精度の高い，揺るぎない成果を生むために必須であると信じられ，種々の臨床研究において多くの時間と労力，経費を投入して実施されている．しかし，そこには解決すべき問題点が少なくなく，研究実施者(臨床医)と病理医，双方にとって有形無形の不利益が生じている．こうした問題点に対し解決の糸口をつかむためには，病理医の実情を代弁できる何らかの機構が，臨床医と生物統計家を主力とする臨床研究グループとの調停に関与する必要がある．JCOGやJPLSGでは病理委員会がそうした立場からの発言を行っている[10]．特に日常の診療業務以外で各施設の病理部門にかかる負担をどのように解決して貢献すべきなのかは，施設内でのその場しのぎの工夫に依存している現状にあると思われ，そうであるかぎり病理中央診断の，ひいては多施設共同臨床研究の基盤は決して盤石とはいえないと思われる．

謝辞：本稿の記載にあたり，貴重な資料を提供していただいた日本病理学会コンサルテーション委員会森永正二郎委員長，同コンサルテーション事務局 菊川敦子さんに深謝いたします．

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Telepathology in Japan

Takashi Sawai

A concept of telemedicine has been present from old days, and occasionally the necessity appeared in private and public lives. Recently, with the progression of information technology (IT), telemedicine has been of interest not only to the medical field but also to the government (Fig. 10.1). Telemedicine in Japan is comprised of mainly three factors: one is telehomecare, the second is teleradiology, and the third is telepathology, in which pathological and/or cytological images are transferred from medical institutes to the pathologists in remote institutes by cables (Fig. 10.2). Several causative factors that promote the telepathology in Japan are considered as shown in Fig. 10.3. One of the most important factors is a shortage of diagnostic pathologists. Before addressing telepathology itself, it is important to get a quick overview of diagnostic pathology in Japan. Then characteristic of Japanese telepathology is introduced and discussed from the medical, economical, and technological aspects for next development.

10.1 The Present Conditions of Japanese Diagnostic Pathology and the Background of Development of Telepathology

In 2004, there were 1,900 diagnostic pathologists recognized by the Japanese Society of Pathology (JSP), accounting for only 0.7% of the total number of physicians in Japan and showing only minimal growth (Fig. 10.4). This is the most severe doctor shortage of any field in Japan, followed in order by pediatricians, OB/GYNs, and anesthesiologists. As illustrated in Fig. 10.5, the ratio of pathologists to the general population is only about 20% of what it is in the United States. Pathologists have traditionally performed autopsies, biopsies, cytodiagnoses, and intraoperative rapid diagnosis. More recently, pathologists also run clinicopathological conferences (CPCs) for residents and clinicians. The most recent available JSP study shows that Japan's pathologists perform 32,000 autopsies, 5.5 million biopsies, 11 million cytodiagnoses, and 100,000 rapid diagnoses annually. All of these duties are increasing except autopsies year by year (Fig. 10.6), but the pathologists and their works has not been well

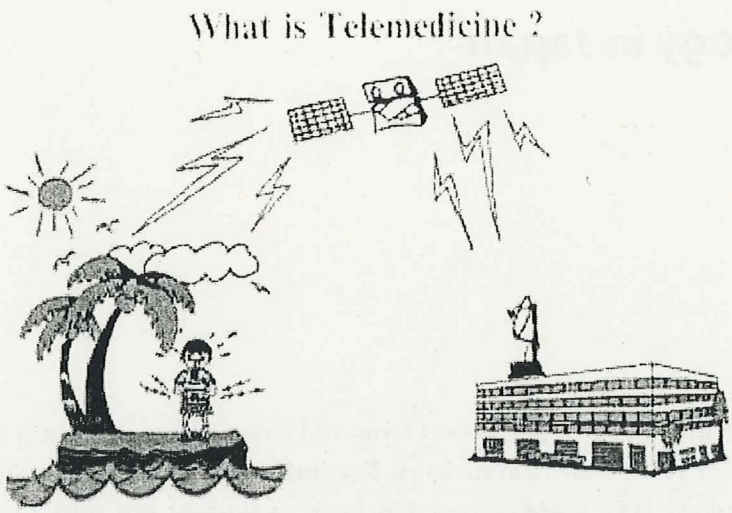


Fig. 10.1. What is telemedicine? The concept of telemedicine has been present in the social life from the old days

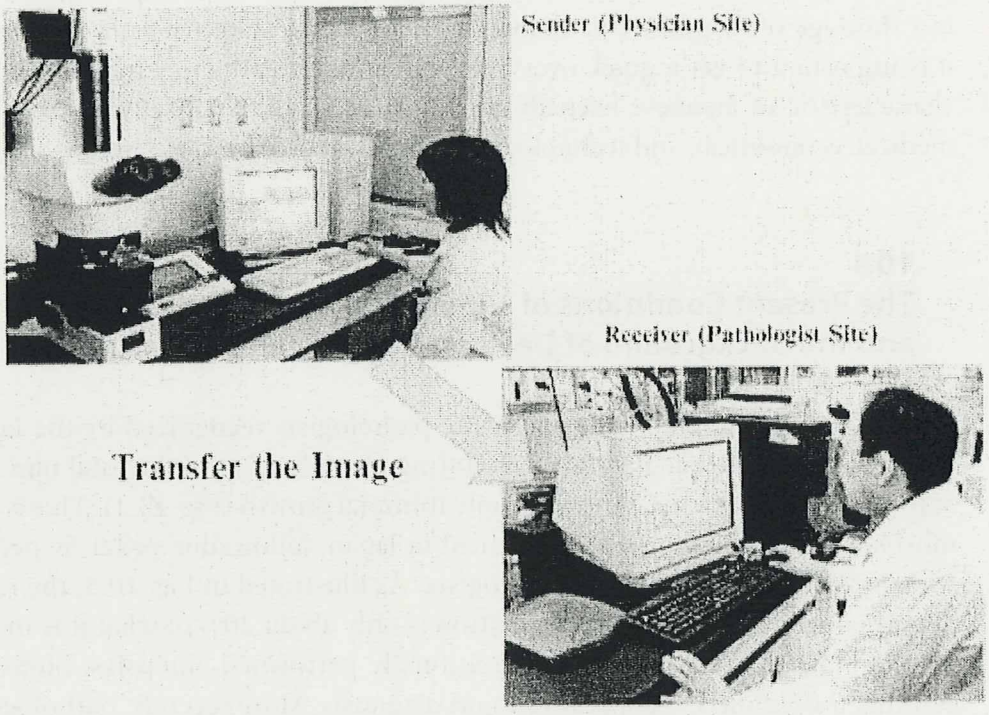


Fig. 10.2. Telepathology system via ISDN. This still image system is now the most spreading type and amounts to 75% of all systems in Japan. The pictures are transferred via ISDN. This system is introduced in 1992 between Tohoku University in Sendai city and Koritsu-Kesennuma Hospital in Kesennuma city in costal region, about 70 km distance

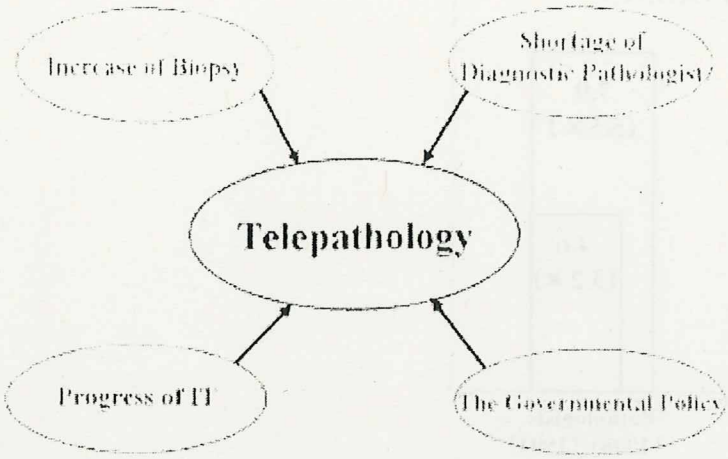


Fig. 10.3. Background of telepathology development. Among many factors that promote telepathology increase of biopsy samples, shortage of diagnostic pathologists, IT progress, and policy by the Governmental are major factors

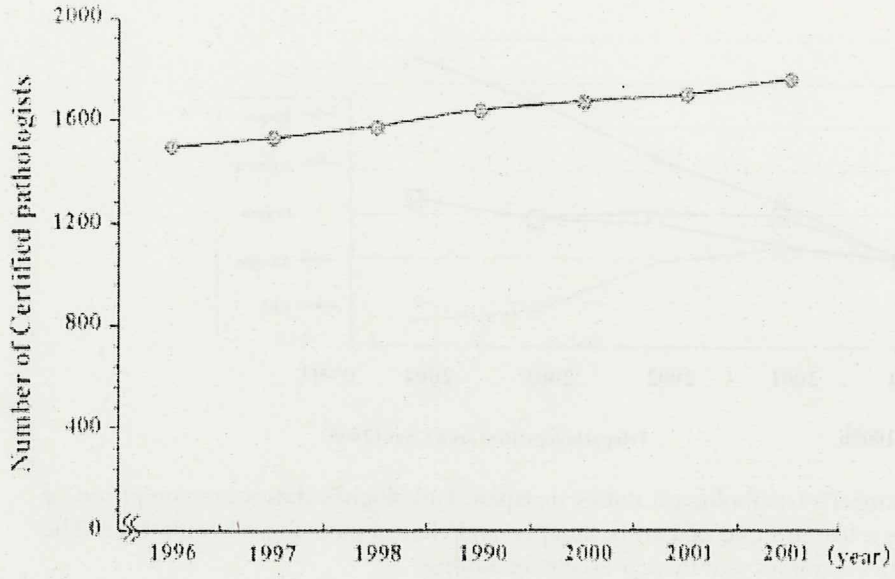


Fig. 10.4. Number of diagnostic pathologists. The number of pathologists increases gradually but still insufficient in Japan

recognized in Japanese society in spite of their important roles (Fig. 10.7). For example, the situation in northern part of Japan (Tohoku Area) is illustrated in Fig. 10.8. Despite having 868 hospitals with 200 or more beds, full-time pathologists are almost exclusively confined to university hospitals and major hospitals in the prefectural capitals. Even large hospitals in other major cities rarely have full-time pathologists on staff [12–14].

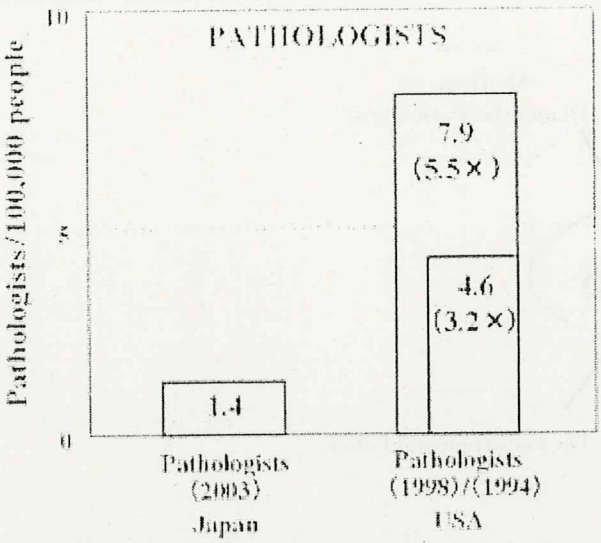


Fig. 10.5. Comparison of pathologist' number between Japan and USA. The numerical ratio of pathologists to the general population is only about 20% compared with one in the USA

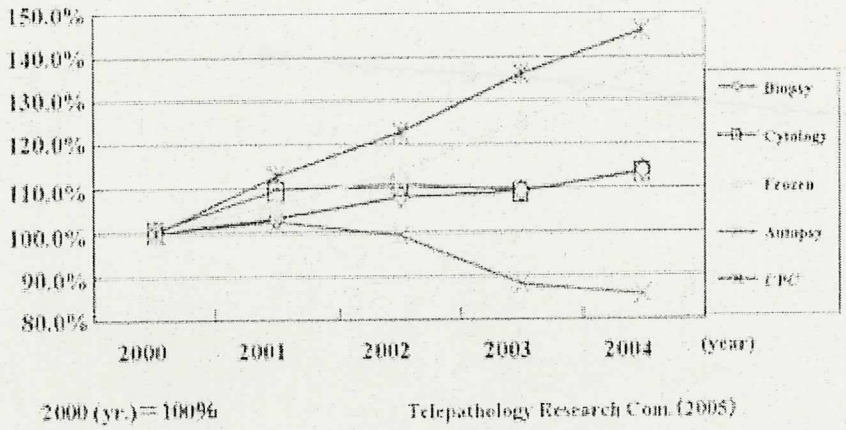


Fig. 10.6. Number of pathological duties in Japan. Pathologist's duties are comprised of biopsy, cytology, frozen rapid diagnosis, autopsy, and clinical pathological conference. The number of duties increases year by year except for autopsy

For this reason, biopsies and cytodiagnoses are often outsourced to university, public, or private laboratories. Generally it takes about several days to a week to get a diagnosis. Under these circumstances, it is impossible to perform intraoperative rapid diagnosis for decision of a next surgical step, especially on a cutoff margin, and has been left to the experience and intuition of the surgeons, as shown in Fig. 10.9. A veteran surgeon's judgment can be accurate relatively, but, in case of new and inexperienced cases or tumors with unclear boundaries, even experienced surgeons hesitate to carry out the operation. Tumors not fully

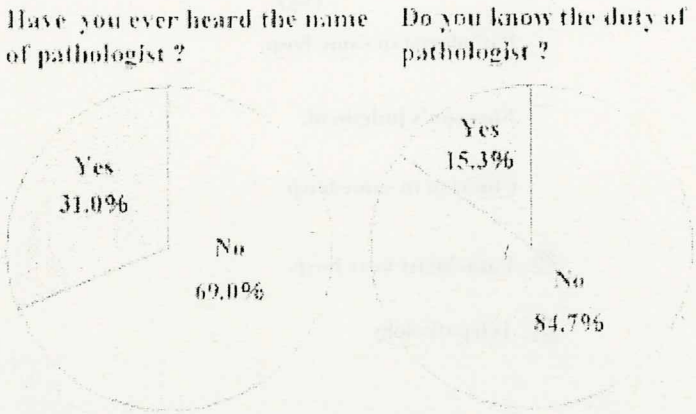


Fig. 10.7. Public consciousness relating pathologist and their duties in Japan. Pathologists and their duties are surprisingly not known publicly in Japan

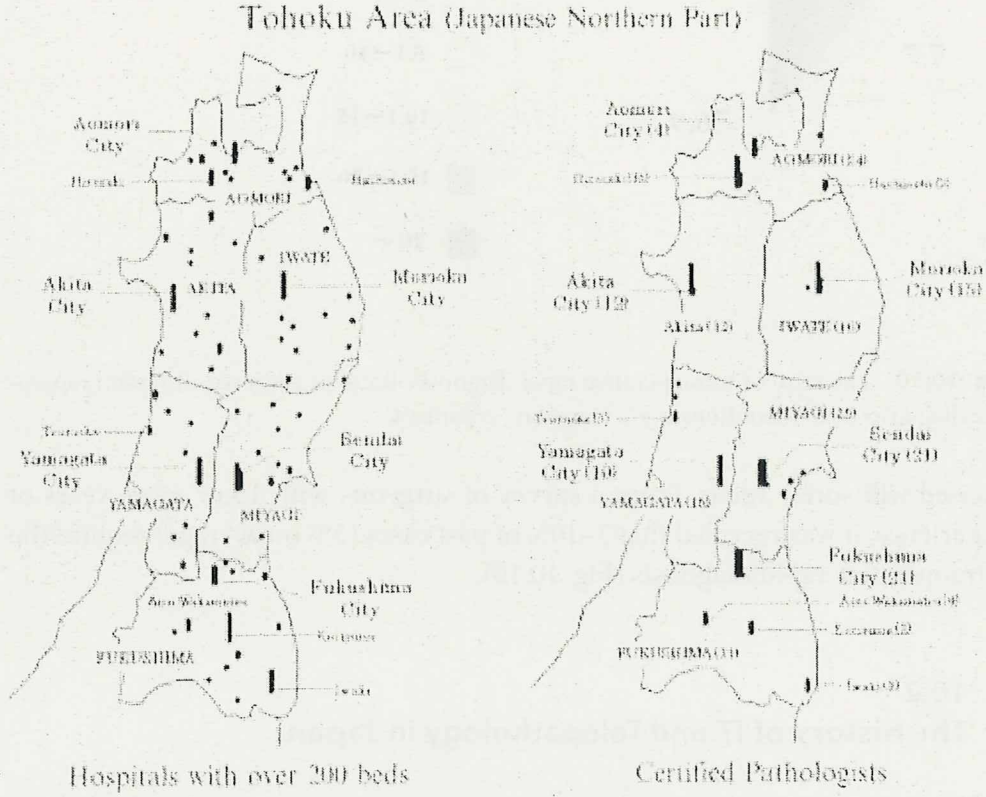


Fig. 10.8. Distribution of hospitals with more than 200 beds (*left*) and hospitals with certified pathologists (*right*). The number of pathologists is very small in northern part of Japan and most of all converge into university and large hospitals in large cities

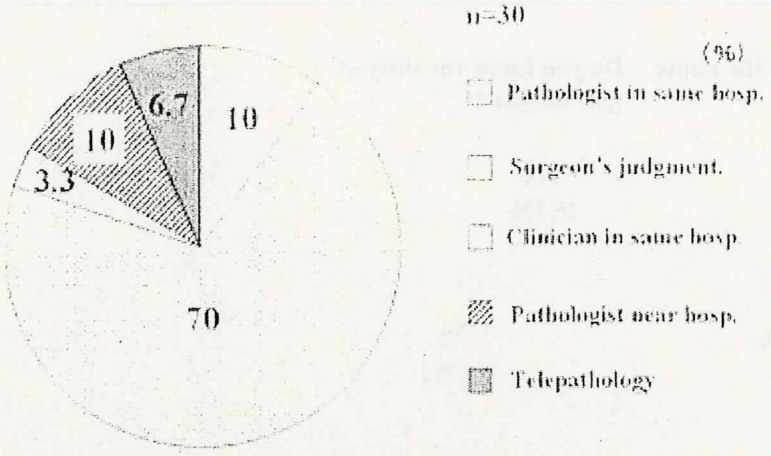


Fig. 10.9. In case of necessity who diagnoses rapidly? In the hospital without pathologists, quick decision related to next step in operation is dependent on surgeon's experience and intuition

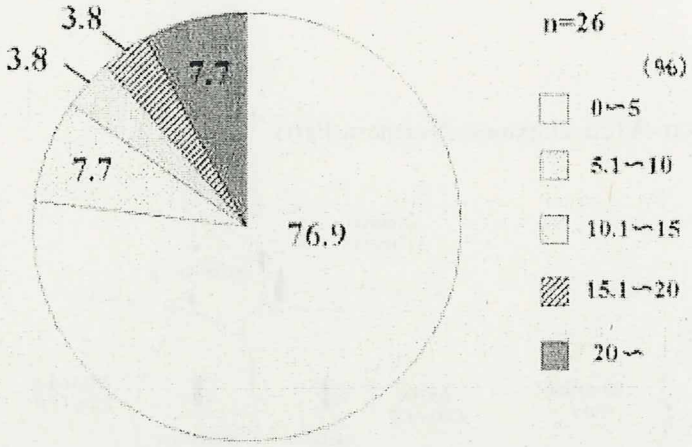


Fig. 10.10. The ratio of intraoperative rapid diagnosis. Ratio of cases requiring intraoperative diagnosis to all operations is 5% (surgeons' comment)

excised will surely recur. From a survey of surgeons with 15 or more years of experience, it was revealed that 3–10% of past cases (5% on average) require the intraoperative rapid diagnosis (Fig. 10.10).

10.2 The History of IT and Telepathology in Japan

The background of telepathology development in Japan is shown in Fig. 10.3. Among them, most noticeable and influential fields in development of information technologies are the spread of the Internet. Microscopic imaging, for example,

has seen enormous advances with the digitization of images, and it has become possible to quickly and easily transfer images to distant locations. However, pathologists who diagnose by optical microscopy systems have felt a great deal of resistance to image only diagnosis, more than troublesome, and not sufficiently developed systems. Indeed, early telepathology images were vastly inferior to microscopic images and had a risk of misdiagnoses. An additional problem was that it took a longer time to diagnose with still images compared with optical microscopy, and the frustration occurred to both clinicians and diagnosticians. For these reasons, many pathologists were not enthusiastic about the practicality of telepathology.

In 1982, what was probably the world's first telepathology in color experiment was carried out by Dr. Hiroshi Sakaguchi of Keio University in Tokyo [7]. This test linked the university to a hospital in Hachioji (also in Tokyo). A quarter century after this experiment using analog phone lines, fiber optics and digital images are becoming the norm. Almost a decade later, at the 23rd Japan Medical Congress in 1991, the Kyoto Prefectural University of Medicine linked with Yosanoumi Hospital (on the Japan Sea side) to demonstrate telepathology, which was subsequently added to the university's normal operations. The National Cancer Center also hooked up its main hospital in Tsukiji, Tokyo, with Hospital East in Kashiwa, Chiba, and Yamagata University connected its Faculty of Medicine with the University Hospital via optical fiber. The following year, at the 81st meeting of the JSP, Tohoku University was linked with Sendai City Hospital through optical fibers for a video (motion picture) telepathology experiment [11]. At this stage, each facility was researching and developing its own telepathology formats.

10.3 Recent Governmental Policy and Activity to Telepathology

Recently, the prevalence of telepathology has been accelerating. Among the changing societal factors for the development of telepathology are continuing the condition of shortage of diagnostic pathologists (Fig. 10.4), the prevalence of the Internet, and the societal shift to computerization in social activity, including medical filed, medical accidents, and patients' increasing desire for a second opinion. In addition, the establishment of a Telemedicine Research Committee by the Health and Welfare Ministry (the current Ministry of Health, Labor, and Welfare, or MLHW) cannot be ignored. The research group, initially headed by Dr. Shigekoto Kaihara of the University of Tokyo (currently dean of the graduate school of the International University of Health and Welfare), researched homecare, teleradiology, and telepathology. Another significant event in the history of telepathology came in 2000, when telepathology was

included as an insured health-care service. This was followed by the expansion of diagnostic facilities in 2003. The MLHW's official acceptance of telepathology represented a change from its previous policy of recognizing only direct, face-to-face medicine, and this was a major impetus for the spread of telepathology. The telepathology research committee supported by MLHW defined that telepathology is to do something related to a medical action associated with medical practice, education, and research from the distant area on the basis of information of macro- and microscopical images.

Although some aspects of telepathology such as added fees required for equipment and telecommunication are still unclear, recent surveys[] have shown that the usage of telepathology is steadily, although gradually, increasing. In 2004, 55 facilities were linked with 120 hospitals and clinics to provide telepathological services for nearly 2,600 cases (Fig. 10.11). Apart from the telemedicine research group supported by the government, pathologists, physicians, cytologists, vendor, and developer of private company established the group named the "Japanese Research Society of Telepathology and Telepathology Informatics" (JRST-TI) in 2000, had made a guideline for Japanese usage in 2003 [19], and changed the name to the "Japanese Research Society of Telepathology Virtual Microscopy" (JRST & VM), now examining a guideline for a telecytology and application for virtual microscopy.

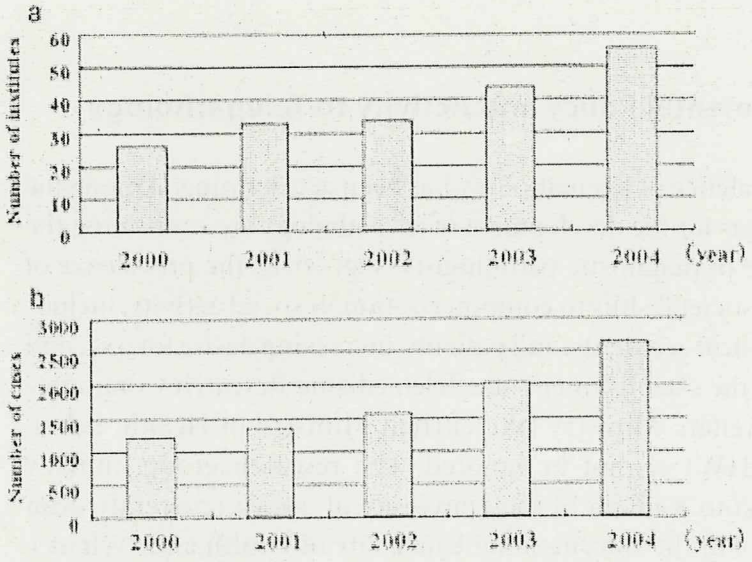


Fig. 10.11. Number of institutes practicing telepathology and the number of cases. Institutes and number of cases practicing telepathology increase gradually year by year

10.4
The Purpose of Japanese Telepathology, Especially Intraoperative Rapid Diagnosis

In Europe and the United States, telepathology is used widely in consultations, but in Japan, it is overwhelmingly used for intraoperative rapid diagnosis (Fig. 10.12). One of the reasons for this difference is that telepathology in Japan began from rapid diagnosis under the auspices of the MLHW. This intensive government support for telepathology is characteristic and may be different from other countries in the world. The other reason for development is the latent clinical desire for rapid diagnosis for telepathology. In the future, because of patients' increased consciousness in medicine and a spate of recent medical lawsuits, it seems likely that telepathology will be used increasingly in consultations and second opinions and other purposes relating images.

Generally, rapid telepathological diagnosis is used for diagnosis of malignant tumors and metastasis, and for confirmation of cutoff margin whether tumor is still left or not (Fig. 10.13) [23]. I, here, introduce two surgical cases, one is a need for a further resection and the other is finished without additional excision in a short time owing to diagnosis of telepathology (Figs. 10.14 and 10.15). These are the large benefits of telepathology viewing from the point of medical and economical aspects.

In the past, the MLHW requested a study of the relationship between rapid diagnosis and the recurrence of tumors. In other words, the ministry wanted to know with what frequency cancers recurred, as rapid diagnosis had not been performed. When it became clear that there was no hope of cooperation from

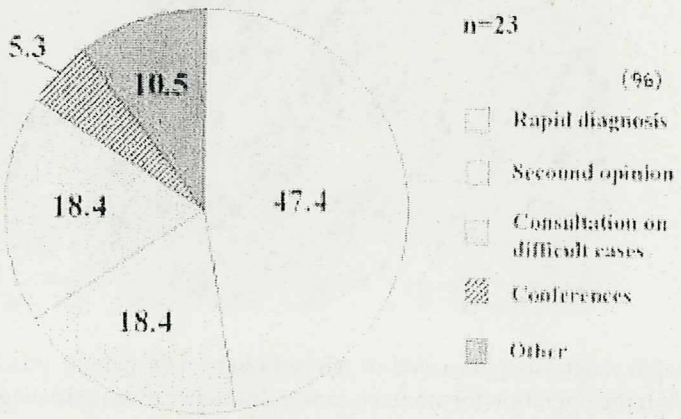


Fig. 10.12. The purpose of telepathology. The telepathology is used for intraoperative rapid diagnosis, second opinion, consultation, and pathological and clinical pathological conference

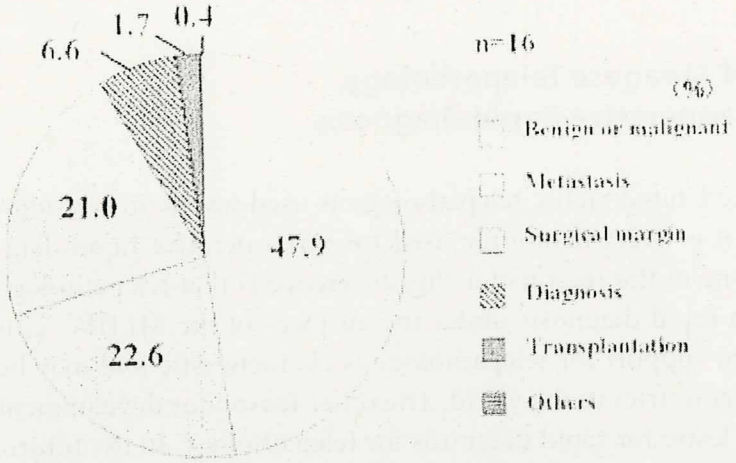


Fig. 10.13. The purpose of intraoperative rapid diagnosis. Diagnosis whether the tumor is malignant or benign, confirmation of metastasis, and cutoff margin are major purposes of intraoperative rapid diagnosis for decision of next step quickly

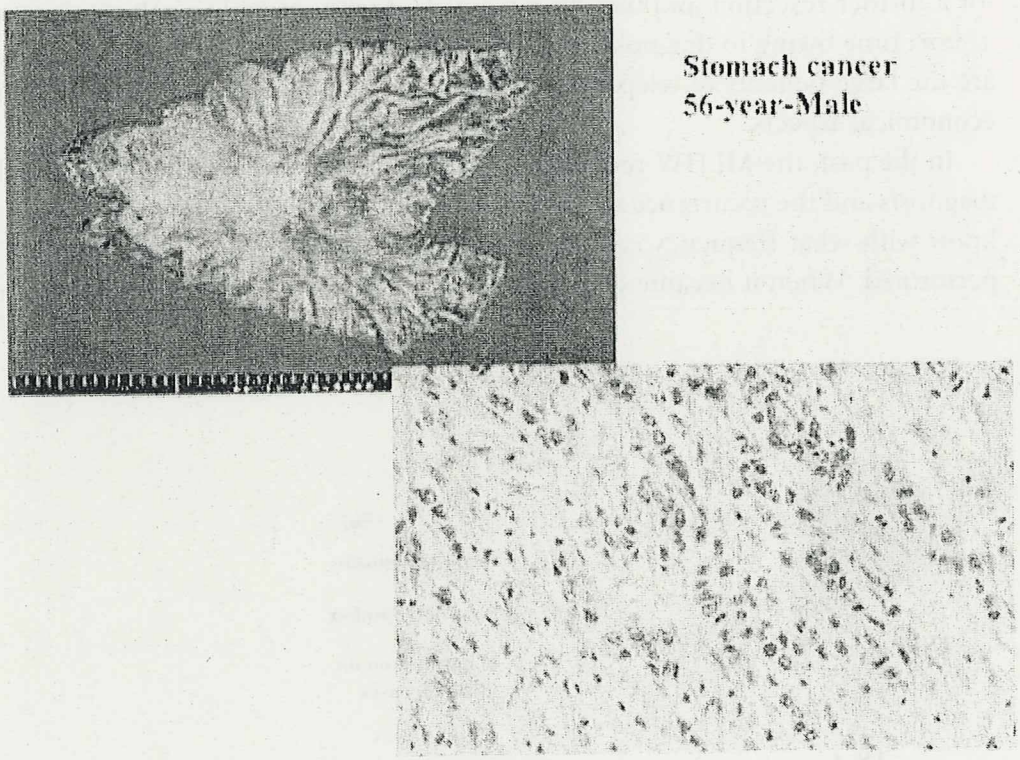
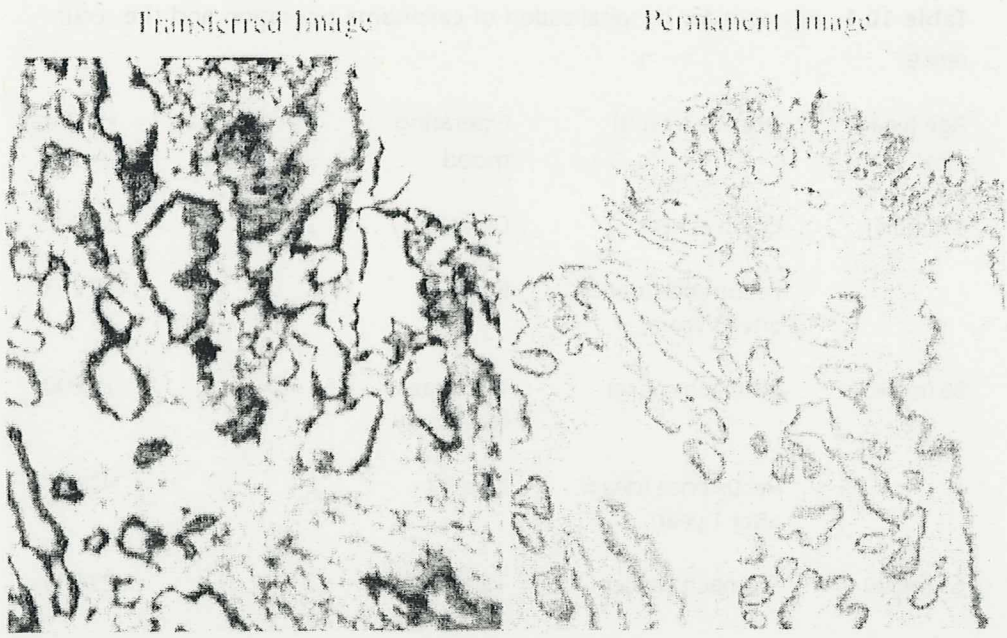


Fig. 10.14. Intraoperative rapid diagnosis performed in telepathology. The patient was a 56-year-old male. He underwent the operation for stomach cancer. Intraoperative rapid diagnosis in telepathology revealed the cancer residue in cutoff margin at esophago-cardiac junction, and further excision was performed



66-year-Female
Clin. Diag.: Carcinoma of common bile duct
Pathol. Diag.: Adenoma, not malignant

Fig. 10.15. Intraoperative rapid diagnosis by telepathology. The patient was a 66-year-old female. She underwent the operation for carcinoma of common bile duct. Intraoperative quick diagnosis by telepathology showed that the tumor was adenoma, not malignancy, against preoperative clinical diagnosis. Operation was finished without further wide resection. She is well now

medical practitioners, the ministry asked, instead, for a report of the percentage of surgeons' requests for rapid diagnosis. Improperly or incompletely removed tumors always recur, endangering patient's lives. But that is not all. Recurrence obviously places enormous physical and emotional burdens on patients and their families and also wastes valuable medical time and resources. Studies have shown that initial operations on gastrointestinal cancers like stomach and colon cancer cost about $18,000 (Table 10.1) and that subsequent therapies in the case of recurrence are never less expensive. On the contrary, Tanita (Japanese respiratory surgeon) reports that using video-assisted thoracoscopic surgery (VATS) for a rapid lung cancer diagnosis and followed by the excision of the same pathological lesion, if necessary, lead to a saving of $4500 compared with performing two separate surgeries [16]. From these facts, it is clear that the pathological intraoperative rapid diagnosis not only improves in patients' prognosis but also brings an economical saving as intensively desired by the MLHW.

Table 10.1. Payment for hospitalization of carcinoma operation and the recurrence

Age (year) (Sex)	Disease (result)	Operating mood	Hospital stay (months)	Hospital fee ($)
67 (male)	Colon cancer	Colectomy	2	11,300
	Recurrence (dead: after 3 years)	Ope (–)	3	18,253
86 (male)	Stomach cancer	Total gastorectomy	1	19,600
	Recurrence (dead: after 1 year)	Ope (–)	2	9282
63 (male)	Stomach cancer	Total gastorectomy	2	23,905
	Recurrence (dead: after 2 years)	Ope (–)	1	10,124

Charge to be paid is not so different between the first operation and the recurrence, that is to say, the recurrence of tumor brings a large economical burden as well as time, labor, and patient's life

10.5 Development of Infrastructure and Telepathology Systems in Japan

Telepathology systems require both hardware and software. Hardware is mainly IT dependent, including communications infrastructure, digital cameras, computers, and microscopes. Software applications provide the tools to effectively use this infrastructure. In its infancy, telepathology relied entirely on analog phone lines. Integrated Services Digital Network (ISDN) subsequently became available, then multiple ISDN lines were bundled together, and most recently the field has begun to move to asymmetric digital subscriber lines (ADSL) and optical fiber cable. These developments have vastly increased the amount of transferable data (Fig. 10.16). Mobile telepathology is also being developed. Although it initially relied on communications satellites, mobile telepathology benefits from the technological advances seen, for example, in mobile phones, which are now able to receive image data on the move. However, issues including image quality, operability, and internationalization remain unresolved.

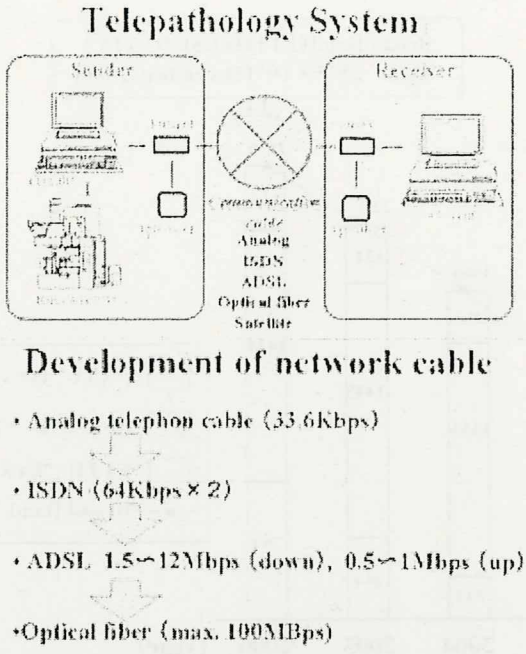


Fig. 10.16. Telepathology system (*upper*) and network development (*lower*). In short time, network cable has developed from analog cable through ISDN, ADSL, to recent optical fiber

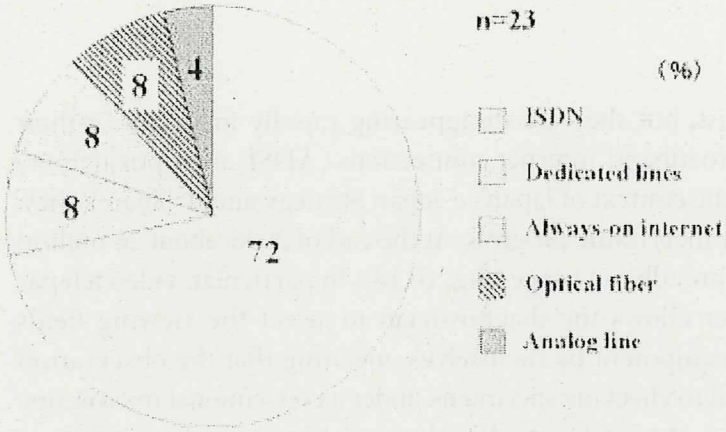


Fig. 10.17. The infrastructural cables used for telepathology (2002). Although the ISDN was most utilized cable for telepathology in 2002, the broadband (ADSL and optical fiber) may take place now, including still, video, and virtual pictures in a short time

As shown in Fig. 10.17, rather old data, the overwhelming majority of telepathology systems rely on the transfer of still images over ISDN lines. Although in most cases the pathologists on diagnostic site is able to select the field by remote control, some systems still require the physician who requests the diagnosis on sending site to operate system by himself. Analog telepathology formats using

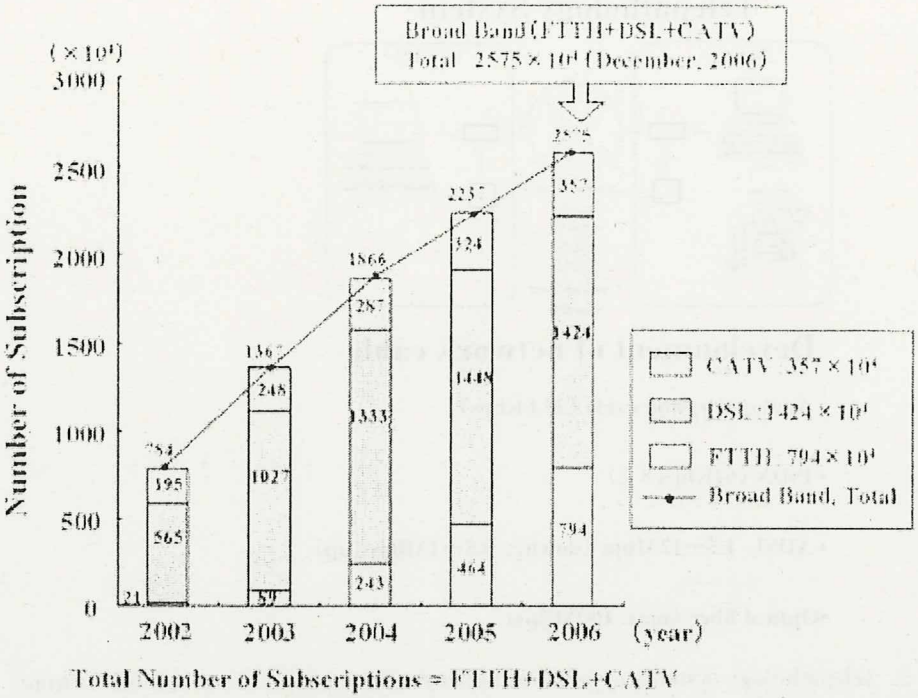


Fig. 10.18. Number of broadband subscriptions. Number of subscriptions of broadband including CATV, DSL, and FTTH increases rapidly in Japan by the aid of the Japanese government

telephone lines still exist, but they are disappearing rapidly in Japan. In their places, formats using broadband Internet connections (ADSL and optical fiber) have appeared, and, in the context of Japan's e-Japan Strategy and u-Japan Policy, expectations are high for their future progress. At the end of 2006, about 26 million families subscribed for broadband usage (Fig. 10.18). In particular, video telepathology via optical fiber allows the diagnostician to select the viewing fields freely and operate the equipment by themselves, meaning that the observation process is nearly identical to checking specimens under a conventional microscope directly (Fig. 10.19). This video telepathology has brought astonishing effect on saving time for intraoperative rapid diagnosis, as shown in Table 10.2 [15].

10.6 Telepathology Applications in Medical Field

As noted earlier, telepathology is currently being used in intraoperative rapid diagnosis, provision of second opinions, consultations, and conferences (Fig. 10.12). Rapid diagnosis employs telepathology to diagnose whether malignancy or not.

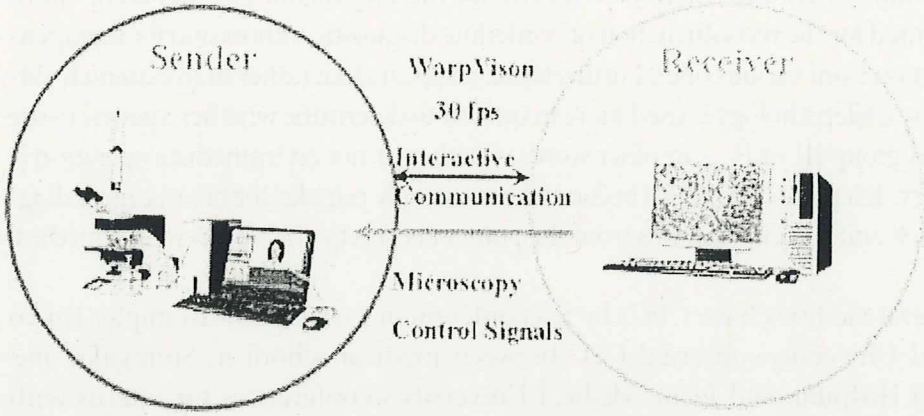


Fig. 10.19. Video telepathology system. Selecting the visual field and focusing are operated by observer freely, as well as direct optical microscopy using remote controller via optical fiber

Table 10.2. Intraoperative rapid diagnosis by video image via optical fiber

Telepathology via video system (11.1.2004 to 1.15.2005)				
No.	Organ	Sample Size (mm)	Time (min)	Diagnosis
1	Margin, pancreas	20 × 15	3	No carcinoma infiltration
2	Margin, stomach	8 × 20	3	No carcinoma infiltration
3	Margin, stomach	5 × 35	6	No carcinoma infiltration
4	Margin, stomach	10 × 7	6	No carcinoma infiltration
5	Margin, stomach	12 × 8	4	No carcinoma infiltration
6	Margin, duodenum margin, esophagus	3 × 85 × 9	43	No carcinoma infiltration
7	Margin, stomach	5 × 10	7	No carcinoma infiltration
8	Margin, pancreas	20 × 15	3	No carcinoma infiltration
Mean time—4.3 min/slide				

The pathologist can freely select the visual field as well as adjusting the focus of the slides glass on the table of optical microscopy from the remote institute as if seeing the optical microscopy directly. Mean time of intraoperative rapid diagnosis by video image is accomplished in 4.4 min/case, very short compared with still image in 35 min/case

classify tumors, confirm metastasis, and decide the surgical margin. Second opinions are required for the reconfirmation of borderline diagnostic tumors and for therapeutic selection from various ones. Furthermore, it appears that rather than extremely difficult cases, telepathology is used more frequently to determine whether a gastric tissue biopsy is group III or IV – in other words, whether or not an immediate operation is necessary. Telepathology is also becoming increasingly popular for breast cancer diagnosis [3,8] and second opinions from the point of cosmetic therapy as well as medical one.

Several facilities have CPCs by teleconferencing system, for example, Tokyo Medical University's internal CPC between medical school in Shinjyuku and Hachoji Hospital, and Iwate Medical University's conferences for interns with the Kuji Prefectural Hospital in the Sanriku area (on sea side) over a steep mountain, using the teleconferencing technologies. We had a teleconference linking 301 hospitals in Beijing in China over the Internet (Fig. 10.20) [22] and also had a video teleconference with Ryukyus University in Okinawa, the most southern

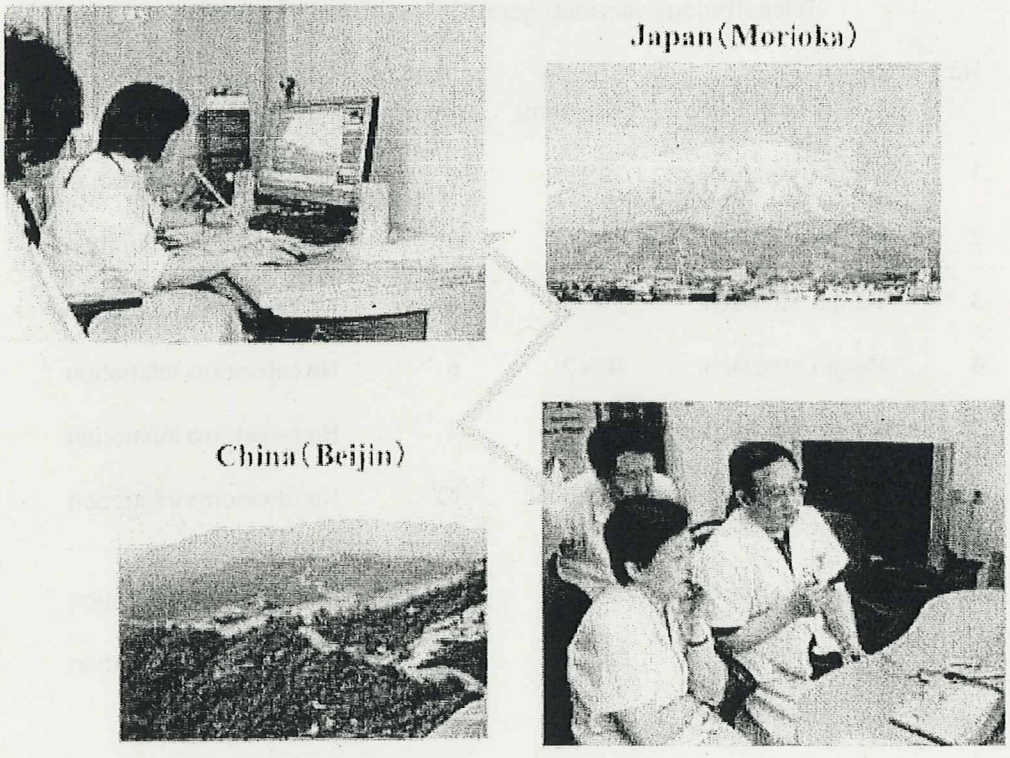


Fig. 10.20. International telepathology conference. The conference is held in September 2006 between Japan (Morioka) and China (Beijing), via cables of optical fiber at Japan site and ADSL at China site

islands area in Japan, about 2,000 km away from our IWATE Medical University, via optical fiber.

Telepathology is applied for community medicine and for the treatments in many fields. One of them is for operation of pulmonary cancer [1], associated with smoking, which is increasing in number (women in particular). Another is transplant medicine [4,5], for which there are not enough specialists in Japan. Second opinions are often sought regarding surgical procedure in hemopathies requiring emergency treatment, and breast cancer or prostatic cancer. Recently, the telecytology has also been paid attention via Internet or optical fiber [24,25]. For now, suffice it to say that telepathology is effective in many situations and offers outstanding medical and economic benefits.

10.7 The Telepathology System in Future

10.7.1 The Government Strategy to Telepathology

As it is impossible to increase the number of pathologists rapidly in the near future in Japan, telepathology for elevation of a medical level is necessary. Japan's e-Japan Strategy and u-Japan Policy assure that the nation's optical fiber infrastructure will continue to grow. Given this, discussions on the future of telepathology can be predicated on the existence of increasingly universal broadband telecommunications. It seems likely that, depending on the cable infrastructure of optical fiber, telepathology using video (motion) and/or many still images may well become the norm. On the while, virtual microscopy, in another word, the digital microscopy, has been increasingly introduced recently in Japan, because the MLHW endeavor to promote "the cancer control strategy" in which digital microscopy is recommended for establishing the consultation system via web servers (Fig. 10.21). MLHW established the new group for standardizing the medical levels, including diagnoses and therapeutics. By the governmental quick action, about 100 medical institutes introduced the digital microscopy in only half a year. Probably the number of digital microscopes in Japan is second next to USA in the world. This digital microscope is also available for the education such as histological and pathological studies and already used in several medical schools, which has brought the discussion, in medical education, whether traditional optical microscopy is necessary or not in the practical training for medical students [2,17,18]. However, the digital microscope now requires a long time to load the images for using intraoperative rapid diagnosis.