CTや核医学検査を繰り返すことにより乳がんリスクが上昇する（Abstract # LL-HPS-TU3A）

心臓や胸部CT画像を繰り返すことにより若年女性の10年間の乳がんリスクが2倍以上になる

Repeat cardiac and chest CT imaging more than doubles a young woman's 10 year risk of breast cancer

約250,000人の女性における2000～2010年の記録を再検討した結果、若年女性や検査を繰り返された患者など一部の女性においてCTや核医学検査が多いことにより乳がんリスクが上昇することが示されたとの研究結果が、2012年Radiological Society of North America年次集会で発表された。研究者らは、乳房被曝のCT検査を施行された患者1,656人のCT放射線量情報を収集し、新たな自動計算法を用いて患者の有効被曝量および乳房に吸収された放射線量を推定した。また核医学検査を受けた患者5,507人における放射線医薬品の用量およびそれに伴う被曝量を解析した。その後、女性らの画像検査に関連した乳がんリスクを推定し、潜在的乳がん発症リスクとを比較した。胸部およびまたは心臓CT検査を数回受けた女性は、乳がん発症リスクが20%高かった。乳がんのリスクファクターを有さない小児または若年成人であれば、10年間の乳がん発症リスクは倍になると考えられる。画像検査関連リスクを低下させるために筆者らは、各々の検査に伴う被曝量を解析し多時相プロトコールの使用を減らし可能な限り被曝量軽減ソフトウエアを導入し被曝量を最小とするように助言している。

Full Text

Researchers reviewing the records of approximately 250,000 women enrolled in an integrated healthcare delivery system found that increased CT utilization between 2000 and 2010 could result in an increase in the risk of breast cancer for certain women, including younger patients and those who received repeat exams. According to the study, which was presented at the 2012 annual meeting of the Radiological Society of North America (RSNA), nuclear medicine examinations may also contribute to increased breast cancer risk.

"When a woman undergoes CT or nuclear medicine imaging of her chest, abdomen or spine, her breast tissue will absorb some radiation," said senior author Rebecca Smith-Bindman, M.D., professor of radiology and biomedical imaging at the University of California, San Francisco. "Breast tissue is one of the tissues in the body known to be sensitive to developing cancer as a result of radiation exposure."

The study, led by Ginger Merry, M.D., M.P.H., breast imaging fellow at Prentice Women's Hospital – Northwestern Memorial Hospital in Chicago, found that among the system's female enrollees, CT utilization increased from 99.8 CT scans per 1,000 women in 2000 to 192.4 CT scans per 1,000 women in 2010 (an annual increase of 6.8 percent). In 2010, 46 percent of those CT examinations exposed the breast to radiation. Nuclear medicine imaging decreased from 39.3 scans per 1,000 women in 2000 to 27.5 scans per 1,000 women in 2010 (a 3.5 percent annual decline); however, in 2010, 84 percent of nuclear medicine studies exposed the breast to radiation.

"Until now, the impact of this increased use of imaging on radiation exposure to breast tissue and the subsequent risk of breast cancer has not been known," Dr. Smith-Bindman said. "Our goal was to quantify imaging utilization and radiation exposure to the breast among women enrolled in an integrated healthcare delivery system and to use these data to determine the imaging-related risk of breast cancer from those studies."

The research team collected CT dose information from 1,656 patients who underwent CT examinations that exposed the breast to radiation and, using a new automated computational method, estimated the patients' effective radiation dose and the amount of radiation absorbed by the breast. The team also analyzed the radiopharmaceutical volume and associated radiation exposure used in 5,507 nuclear medicine exams that exposed the breast to radiation. "We found that the estimated breast radiation doses from CT were highly variable across patients, with the highest doses coming from multiple-phase cardiac and chest CT examinations, where successive images of the organ being studied are captured," Dr. Smith-Bindman said.

The researchers then estimated the women's imaging-related risk of breast cancer and compared it to their underlying risk of developing breast cancer. Each woman's 10-year imaging-related risk of developing breast cancer, beginning 10 years after her exposure to imaging and based on her age at exposure, was estimated using the breast-specific radiation data and a statistical risk model. A women's underlying risk of developing breast cancer was estimated based on data collected by the National Cancer Institute-funded Breast Cancer Surveillance Consortium.

"Young women receiving several chest and or cardiac CTs had the greatest increased risk of developing breast cancer at approximately 20 percent," said Diana Miglioretti, Ph.D., study coauthor and senior investigator at the Group Health Research Institute. "A child or young adult with no risk factors for breast cancer would double her 10-year risk of developing breast cancer."

To lower imaging-related risk of developing breast cancer, Dr. Smith-Bindman said imaging providers should analyze the radiation doses associated with each exam, reduce the use of multi-phase protocols and employ dose-reduction software wherever possible to minimize exposures.

"If imaging is truly indicated, then the risk of developing cancer is small and should not dissuade women from getting the test they need," she said. "On the other hand, a lot of patients are undergoing repeat chest and cardiac CT, many of which aren't necessary. Women, and particularly young women, should understand there is a small but real potential risk of breast cancer associated with cardiac and chest CT, and the risk increases with the number of scans."

Coauthors are Choonsik Lee, Ph.D., and Eric Johnson, M.S.

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スクリーニングのマンモグラフィーで検出されたがんの20%近くが40～49歳の女性であった

Nearly 20 percent of cancers detected with screening mammography were among women between ages 40 and 49

2009年にU.S. Preventive Services Task Force（USPSTF）により発行されたスクリーニングマンモグラフィーに関する改定ガイドラインの影響を評価した結果、勧告によりがんの見落としやスクリーニング辞退につながる可能性のあることが示されたとの2つのスタディ結果が2012年Radiological Society of North America年次集会で発表された。1つ目のスタディで研究者らは4年間のスクリーニングマンモグラフィーのデータ43,351例を解析し、205例の乳がんを検出した。このスタディでスクリーニングされた女性のうち14,528人、つまり33.5%が40～49歳であった。検出された205例の乳がんのうち39例（19%）は40～49歳であった。これらのがんのうち50%超（39例中21例）は進行の速いがんであった。乳がんと診断された40～49歳の女性のうち、第一度近親者に閉経前乳がんを発症していたのはわずか3人であった。彼女らのデータは、年1回のマンモグラフィーを40歳から開始するとのAmerican Cancer Societyの勧告を支持するものであると筆者らは述べている。2つ目のスタディにおいて研究チームは、2005～2009年にかけての複合年間スクリーニングマンモグラフィー使用率は0.9%上昇したが、2009年から2010年にかけて使用率は4.3%減少したことを明らかにした。

Full Text

Researchers assessing the impact of revised guidelines for screening mammography issued by the U.S. Preventive Services Task Force (USPSTF) found evidence that the new recommendations may lead to missed cancers and a decline in screening, according to two studies presented at the 2012 annual meeting of the Radiological Society of North America (RSNA).

Routine screening mammography has traditionally been recommended by both the USPSTF and the American Cancer Society for all women over the age of 40. In 2009, the USPSTF issued controversial new guidelines recommending routine screening with mammography every two years for women 50 to 74 years old. In the studies being presented at RSNA 2012, researchers analyzed the impact of the new guidelines on women between the ages of 40 and 49 and the Medicare population.

"Recommendations on screening mammography are extremely important public policy and we wanted to contribute to that dialogue," said Elizabeth Arleo, M.D., assistant professor of radiology at New York – Presbyterian Hospital — Weill Cornell Medical College in New York City. "We get questions all day long from patients and referring physicians on the appropriateness of screening mammography. The inconsistent information is very confusing for everyone."

For her study, Dr. Arleo and a team of researchers analyzed data on screening mammography at New York – Presbyterian Hospital — Weill Cornell Medical College between 2007 and 2010. Over the four years, 43,351 screening exams were performed, which led to the detection of 205 breast cancers.

"Nearly 20 percent of cancers detected with screening mammography were found among women in their 40s, Dr. Arleo said. "It seems unacceptable to potentially miss nearly 20 percent of the breast cancers we are identifying. This, in our view, would represent a substantial degree of under-diagnosis."

Of the women screened in the study, 14,528, or 33.5 percent, were between the ages of 40 and 49. Of the 205 breast cancers detected, 39 (19 percent) were found in the 40 – 49 age group. Of those cancers, more than 50 percent (21 of 39) were invasive. Only three of the women between the ages of 40 and 49 diagnosed with cancer had a first-degree relative with pre-menopausal cancer.

"Our data favor the American Cancer Society recommendations of annual mammograms starting at age 40," Dr. Arleo said.

In the second study, a team of researchers analyzed data from The Medicare Part B Physician/Supplier Procedure Summary Master Files for 2005-2010. They calculated the following annual utilization rates for screening mammography per 1,000 female Medicare beneficiaries: 2005, 311.6; 2006, 312.4; 2007, 316.2; 2008, 320.1; 2009, 322.9; and 2010, 309.1.

From 2005 to 2009, the compound annual growth rate for screening mammography utilization was 0.9 percent, compared to a 4.3 percent decline in the utilization rate from 2009 to 2010.

"There was considerable controversy over the task force guidelines, but it was unclear how much they would influence women's choices about screening," said David C. Levin, M.D., professor and chairman emeritus of the Department of Radiology at Thomas Jefferson University Hospital in Philadelphia. "We're not able to tell from the data whether this significant drop in utilization was a result of women deciding to wait another year to have their mammogram, or women over the age of 74 not having the exam. But, clearly, the new USPSTF guidelines have had an effect."

Dr. Levin said the drop in the mammography utilization rate is especially concerning, given that the 2009 rate of 322.9 per 1,000 women wasn't particularly high.

"We'll never see 1,000 out of 1,000 women getting a screening mammogram, but you'd like to see that number closer to 1,000, and certainly higher than 322," he said. "We need to continue to follow these numbers and to watch the breast cancer mortality statistics."

Coauthors of Dr. Arleo's research are Melissa B. Reichman, M.D., Ruth Rosenblatt, M.D., Kemi T. Babagbemi, M.D., and Brittany Zadek Dashevsky, M.D., Ph.D.

Coauthors of Dr. Levin's research are Andrea J. Frangos, M.P.H., Vijay M. Rao, M.D., Laurence Parker, Ph.D., and Richard Sharpe, M.D., M.B.A.

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マンモグラフィーによる散乱放射線はがんリスクとはならない（Abstract # SSG02-07）

スクリーニングマンモグラフィーによる散乱放射線の被曝量は微々たるもので患者に対するリスクは無視できるものである

Scatter radiation from screening mammography is minimal with negligible risk to the patient

マンモグラフィーによる乳房周辺の被曝線量は無視できる程度であるか非常に低く、がんのリスクとはならないものであるとのスタディ結果が2012年Radiological Society of North America学会で発表された。散乱放射線の影響の可能性をより理解するために研究者らは、スクリーニングデジタルマンモグラフィー中に甲状腺、唾液腺、胸骨、子宮および水晶体の被曝量を計測した。スタディ対象群の女性207人それぞれが2方向のスクリーニングマンモグラフィー施行中に6つの光刺激ルミネセンス線量計を装着した。検査直後の線量計の解析の結果、乳房以外の数か所の被曝量は無視できる程度から非常に低い程度の範囲内であった。例えば、唾液腺や甲状腺への臓器平均被曝線量は0.05mGyと推定された。これらの放射線量は人々が浴びる自然放射線の一部に過ぎない。実際、胸骨以外の全ての部位の被曝量は年間自然放射線被曝量の2%未満であった。目から臍部にかけて計測された被曝量は微々たるものであった。研究者らは、マンモグラフィー施行の際の甲状腺シールドは不要であると述べている。

Full Text

The radiation dose to areas of the body near the breast during mammography is negligible, or very low, and does not result in an increased risk of cancer, according to a study presented at the 2012 annual meeting of the Radiological Society of North America (RSNA). The results suggest that the use of thyroid shields during mammography is unnecessary.

"Thyroid shields can impede good mammographic quality and, therefore, are not recommended during mammography," said Alison L. Chetlen, D.O., assistant professor of radiology at Penn State Hershey Medical Center.

During mammography, some X-rays scatter away from the primary beam in the breast and spread outward in different directions. Although this scatter radiation is much weaker than the primary beam, there has been concern that women exposed to it during mammography could face an increased risk of cancer, especially in radiosensitive areas like the thyroid gland.

To better understand the potential impact of scatter radiation, Dr. Chetlen and colleagues set out to measure the dose received by the thyroid gland, salivary gland, sternum, uterus and the lens of the eye during screening digital mammography. Each of the 207 women in the study group wore six optically stimulated luminescent dosimeters—a device used to measure an absorbed dose of ionizing radiation—while undergoing two-view screening mammography.

Analysis of the dosimeters by a medical physicist immediately after the exam revealed that the doses to the various areas outside of the breast ranged from negligible to very low.

The average estimated organ dose to the salivary gland was 0.05 mGy. The average estimated organ dose to the thyroid gland was 0.05 mGy. These doses are only a fraction of the radiation people are exposed to from natural background sources, such as cosmic radiation and radionuclides in the ground. In fact, all areas except for the sternum received less than 2 percent of annual background radiation dose.

Measured dose to the bridge of the eye and umbilicus was negligible, indicating no increased risk to the patient of cataracts or interference with normal embryonic development in early pregnancy.

"The risk of cancer induction at these low levels is indistinguishable from background incidence of cancer due to other sources," Dr. Chetlen said.

The findings are particularly important in light of a recent increase in the incidence of thyroid cancer, one of the most radiosensitive of all cancers. The number of thyroid cancer diagnoses in women nearly doubled from 2000 to 2008, leading some to suspect that mammography may be a contributing factor and that women should wear lead thyroid shields during exams, an idea that Dr. Chetlen and other mammography experts strongly discourage.

Based on the extremely low scatter radiation dose to the thyroid—equivalent to just a few minutes of background radiation—thyroid shields are unnecessary during mammography. In addition, the researchers warn that use of thyroid shields could result in an increased radiation dose to patients.

"A thyroid shield gets in the way of the exam and can actually cause an increase in radiation dose by necessitating repeat exams," Dr. Chetlen said.

Dr. Chetlen also pointed out that the thyroid gland is far less radiosensitive after age 30. The American Cancer Society and other organizations recommend that women have mammography screening once every year, beginning at age 40.
"In the age group eligible for screening, the thyroid gland is not very radiosensitive," Dr. Chetlen said.

Coauthors are Steven King, M.S., Karen Brown, C.H.P., D.A.B.R., Brian Lorah, Susann Schetter, D.O., Claudia Kasales, M.D., Shelley Tuzzato, R.T.R.M., and Shelly Rambler, R.T.R.M.

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ケモブレイン現象の生理学的エビデンス（Abstract # LL-MIS-TU2A）

PET/CTの結果ケモブレイン現象の症状に関連した局所脳代謝が減少していることが示された

PET/CT demonstrates decreases in regional brain metabolism that are associated with symptoms of the chemo brain phenomenon

ポジトロン断層撮影とコンピューター断層撮影の組み合わせ（PET/CT）により、化学療法を施行されている患者に一般的にみられる副作用であるケモブレイン（集中力や記憶力に影響する）の生理学的エビデンスが認められたとの研究結果が2012年Radiological Society of North America学会で発表された。この愁訴は一般的であるかもしれないが、ケモブレイン現象の原因を特定するのはこれまで困難であった。磁気共鳴画像を用いた過去のいくつかのスタディでは、化学療法後の脳体積の小さな変化が検出されたが、決定的な関連は明らかにされなかった。脳の外観に対する化学療法の影響を調査するのではなく、研究者らはPET/CTを用いて化学療法後の脳代謝の変化を評価した。彼らは乳がんに対し化学療法を施行された患者128人のPET/CT画像の結果を解析した。彼らは化学療法前後の脳代謝の相違を識別するのに役立つ特別なソフトウエアを使用した。その結果を患者の病歴、神経学的所見および化学療法プロトコールと関連付けた。PET/CTの結果、ケモブレイン現象の症状と密接に関連する局所的脳代謝の統計学的有意な減少が示された。特に、計画を立てたり優先順位を付けたりする役割を担うと考えられている脳領域において、化学療法後にエネルギー使用が少なかった。筆者らは、PET/CTは臨床診断を容易にし早期介入を可能とするのに役立つと信じている。

Full Text

Chemotherapy can induce changes in the brain that may affect concentration and memory, according to a study presented at the 2012 annual meeting of the Radiological Society of North America (RSNA). Using positron emission tomography combined with computed tomography (PET/CT), researchers were able to detect physiological evidence of chemo brain, a common side effect in patients undergoing chemotherapy for cancer treatment.

"The chemo brain phenomenon is described as 'mental fog' and 'loss of coping skills' by patients who receive chemotherapy," said Rachel A. Lagos, D.O., diagnostic radiology resident at the West Virginia University School of Medicine and West Virginia University Hospitals in Morgantown, W.V. "Because this is such a common patient complaint, healthcare providers have generically referred to its occurrence as 'chemo brain' for more than two decades."

While the complaint may be common, the cause of chemo brain phenomenon has been difficult to pinpoint. Some prior studies using magnetic resonance imaging (MRI) have found small changes in brain volume after chemotherapy, but no definitive link has been found.

Instead of studying chemotherapy's effect on the brain's appearance, Dr. Lagos and colleagues set out to identify its effect on brain function. By using PET/CT, they were able to assess changes to the brain's metabolism after chemotherapy.

"When we looked at the results, we were surprised at how obvious the changes were," Dr. Lagos said. "Chemo brain phenomenon is more than a feeling. It is not depression. It is a change in brain function observable on PET/CT brain imaging."

For the study, Dr. Lagos and colleagues analyzed PET/CT brain imaging results from 128 patients who had undergone chemotherapy for breast cancer. They used special software to help discern differences in brain metabolism before and after chemotherapy. Results were correlated with patient history, neurologic examinations and chemotherapy regimens.

PET/CT results demonstrated statistically significant decreases in regional brain metabolism that were closely associated with symptoms of chemo brain phenomenon.

"The study shows that there are specific areas of the brain that use less energy following chemotherapy," Dr. Lagos said. "These brain areas are the ones known to be responsible for planning and prioritizing."

Dr. Lagos believes that PET/CT could be used to help facilitate clinical diagnosis and allow for earlier intervention.

Research has already shown that patients with chemo brain can benefit from the assistance of nutritionists, exercise therapists, massage therapists and counselors. In one study, cancer patients receiving chemotherapy complained of losing their ability to prepare family meals.

"When the researchers provided these patients with written and planned menus for each meal, the women were able to buy the groceries, prepare the meals and enjoy them with their families," Dr. Lagos said.

Dr. Lagos and her fellow researchers hope that future studies will lead the way to better treatment for patients experiencing this often debilitating condition.

"The next step is to establish a prospective study that begins assessing new patients at the time of cancer diagnosis," she said. "The prospective study has the potential to establish an understanding of the change in brain neurotransmitters during chemotherapy, which may lead to improved treatment or prevention."

Coauthors are Jame Abraham, M.D., Gary Marano, M.D., Marc Haut, Ph.D., and Sara Kurian, M.S.

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MR画像から身体活動性の脳に対する神経保護的および疾患調整的な影響が示された

MR imaging demonstrates neuroprotective and disease moderating influence of physical activity on the brain

活動的な生活習慣は高齢者の脳灰白質を温存するのに役立ち、認知症やアルツハイマー病（AD）の負担を軽減し得るとのMRIベースのスタディの結果が2012年Radiological Society of North America学会で発表された。研究者らは、活動的な生活習慣がどのように脳の構造に影響するかをCardiovascular Health Studyの対象成人876人において調査した。対象者らの状態は認知機能正常からアルツハイマー性認知症の範囲にわたった。BMIや生活習慣などの20年間の臨床データと磁気共鳴画像（MRI）を用いたボクセルに基づく形態計測法を用いて、エネルギー産出と灰白質体積との関連をモデル化した。年齢、頭囲、認知機能障害、性別、BMI、教育、スタディを行った地域および白質疾患で補正した結果、エネルギー産出と認知機能に極めて重要な脳領域の灰白質体積との間に強力な相関が認められた。カロリー消費が大きいほど海馬、後部帯状回および基底核を含む前頭葉、側頭葉および頭頂部灰白質の体積が大きかった。認知機能正常から臨床的に認知症である状態までの範囲にわたり、エネルギー産出が大きいことと脳組織残存量が大きいこととには強い相関関係が認められた。

Full Text

An active lifestyle helps preserve gray matter in the brains of older adults and could reduce the burden of dementia and Alzheimer's disease (AD), according to a study presented at the annual meeting of the Radiological Society of North America (RSNA).

Dementia exacts a staggering toll on society. More than 35 million people worldwide are living with the disease, according to the World Health Organization, and the prevalence is expected to double by 2030. AD is the most common cause of dementia and currently has no cure.

Cyrus Raji, M.D., Ph.D., radiology resident at the University of California in Los Angeles, and colleagues recently examined how an active lifestyle can influence brain structure in 876 adults, average age 78 years, drawn from the multisite Cardiovascular Health Study. The patients' condition ranged from normal cognition to Alzheimer's dementia.

"We had 20 years of clinical data on this group, including body mass index and lifestyle habits," Dr. Raji said. "We drew our patients from four sites across the country, and we were able to assess energy output in the form of kilocalories per week."

The lifestyle factors examined included recreational sports, gardening and yard work, bicycling, dancing and riding an exercise cycle.

The researchers used magnetic resonance imaging (MRI) and a technique called voxel-based morphometry to model the relationships between energy output and gray matter volume.

"Voxel-based morphometry is an advanced method that allows a computer to analyze an MR image and build a mathematical model that helps us to understand the relationship between active lifestyle and gray matter volume," Dr. Raji said. "Gray matter volume is a key marker of brain health. Larger gray matter volume means a healthier brain. Shrinking volume is seen in Alzheimer's disease."

After controlling for age, head size, cognitive impairment, gender, body mass index, education, study site location and white matter disease, the researchers found a strong association between energy output and gray matter volumes in areas of the brain crucial for cognitive function. Greater caloric expenditure was related to larger gray matter volumes in the frontal, temporal and parietal lobes, including the hippocampus, posterior cingulate and basal ganglia. There was a strong association between high-energy output and greater gray matter volume in patients with mild cognitive impairment and AD.

"Gray matter includes neurons that function in cognition and higher order cognitive processes," Dr. Raji said. "The areas of the brain that benefited from an active lifestyle are the ones that consume the most energy and are very sensitive to damage."

A key aspect of the study was its focus on having variety in lifestyle choices, Dr. Raji noted.

"What struck me most about the study results is that it is not one but a combination of lifestyle choices and activities that benefit the brain," he said.
Dr. Raji said the positive influence of an active lifestyle on the brain was likely due to improved vascular health.

"Virtually all of the physical activities examined in this study are some variation of aerobic physical activity, which we know from other work can improve cerebral blood flow and strengthen neuronal connections," he said.

"Additional work needs to be done," Dr. Raji added. "However, our initial results show that brain aging can be alleviated through an active lifestyle."

Coauthors are H. Michael Gach, Ph.D., Owen Carmichael, Ph.D., James T. Becker, Ph.D., Oscar Lopez, M.D., Paul Thompson, Ph.D., William Longstreth, M.D., Lewis Kuller, M.D., and Kirk Ericson, Ph.D.

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読み書きおよびゲームをすることは脳を健康に保つのに役立つ可能性がある

老年期において認知機能活動が頻回であると多くの脳領域において微細構造の完全性が高い

Frequent late life cognitive activity linked to greater microstructural integrity in a number of brain regions

読み書きなどの知的活動は高齢者の脳組織の完全性を保持し得るとのスタディ結果が2012年Radiological Society of North America年次集会で発表された。このスタディではRush Memory and Aging Projectの高齢参加者152人（平均年齢81歳）を対象とした。参加者は認知症を有さないか軽度認知障害を有する者であった。研究者らは参加者に、知的な興味をもたせるような活動のリストから前年に参加した活動の頻度を1～5で評価させた。これらの知的活動は新聞や雑誌を読むこと、手紙を書くことおよびカードやボードゲームをすることなどであった。参加者は、臨床評価から1年以内に1.5-TMRスキャナーを用いた脳の磁気共鳴画像検査を施行された。研究者らは解剖学的および拡散テンソル画像データを収集し、それを用いて拡散異方性マップを作成した。解析の結果、老年期の認知活動の頻度と脳の拡散異方性の値が高いこととに有意な関連が認められた。筆者らによると、拡散異方性の値は年齢とともに低下する。認知活動頻度の高い高齢者において拡散異方性の値が高いことから、これらの人々は若年者と同様な脳特性を有することが示唆された。

Full Text

Mental activities like reading and writing can preserve structural integrity in the brains of older people, according to a study presented at the 2012 annual meeting of the Radiological Society of North America (RSNA).

While previous research has shown an association between late-life cognitive activity and better mental acuity, the new study from Konstantinos Arfanakis, Ph.D., and colleagues from Rush University Medical Center and Illinois Institute of Technology in Chicago studied what effect late-life cognitive activity might have on the brain's white matter, which is composed of axons that transmit information throughout the brain.

"Reading the newspaper, writing letters, visiting a library, attending a play or playing games, such as chess or checkers, are all simple activities that can contribute to a healthier brain," Dr. Arfanakis said.

The researchers used a magnetic resonance imaging (MRI) method known as diffusion tensor imaging (DTI) to generate data on diffusion anisotropy, a measure of how water molecules move through the brain. In white matter, diffusion anisotropy exploits the fact that water moves more easily in a direction parallel to the brain's axons, and less easily perpendicular to the axons, because it is impeded by structures such as axonal membranes and myelin. "This difference in the diffusion rates along different directions increases diffusion anisotropy values," Dr. Arfanakis said. "Diffusion anisotropy is higher when more diffusion is happening in one direction compared to others."

The anisotropy values in white matter drop, however, with aging, injury and disease.
"In healthy white matter tissue, water can't move as much in directions perpendicular to the nerve fibers," Dr. Arfanakis said. "But if, for example, you have lower neuronal density or less myelin, then the water has more freedom to move perpendicular to the fibers, so you would have reduced diffusion anisotropy. Lower diffusion anisotropy values are consistent with aging."

The study included 152 elderly participants, mean age 81 years, from the Rush Memory and Aging Project, a large-scale study looking at risk factors for Alzheimer's disease. Participants were without dementia or mild cognitive impairment, based on a detailed clinical evaluation. Researchers asked the participants to rate on a scale of 1 to 5 the frequency with which they participated in a list of mentally engaging activities during the last year. Among the activities were reading newspapers and magazines, writing letters and playing cards and board games.

Participants underwent brain MRI using a 1.5-T scanner within one year of clinical evaluation. The researchers collected anatomical and DTI data and used it to generate diffusion anisotropy maps.

Data analysis revealed significant associations between the frequency of cognitive activity in later life and higher diffusion anisotropy values in the brain.

"Several areas throughout the brain, including regions quite important to cognition, showed higher microstructural integrity with more frequent cognitive activity in late life," said Dr. Arfanakis. "Keeping the brain occupied late in life has positive outcomes."

According to Dr. Arfanakis, diffusion anisotropy drops gradually beginning at around age 30. "Higher diffusion anisotropy in elderly patients who engage in frequent cognitive activity suggests that these people have brain properties similar to those of younger individuals," he said.

The researchers will continue to follow the study participants with an eye toward comparing the diffusion anisotropy results over time.

"In these participants, we've shown an association between late-life cognitive activity and structural integrity, but we haven't shown that one causes the other," Dr. Arfanakis said. "We want to follow the same patients over time to demonstrate a causal link."

Coauthors are Anil K. Vasireddi, B.S., Shengwei Zhang, B.Eng., David A. Bennett, M.D., and Debra A. Fleischman, Ph.D.

TOPICS

Oncology

Psychiatry

胎児期のアルコール曝露は脳構造に影響する（Abstract＃VSPD11-05）

母親が妊娠中に飲酒した子供の中枢神経系に対するアルコールの影響に関する新たな知見がMRIにより得られた

MRI provides insights into effects of alcohol on the central nervous systems of children whose mothers drank during pregnancy

胎児成長期にアルコールに曝露された小児は様々な画像技術により明らかな脳構造および代謝の変化を示すとのスタディ結果が2012年Radiological Society of North America学会で発表された。スタディグループには胎児期にアルコールに曝露された小児200人と、母親が妊娠中および授乳中に飲酒をしなかった子供30人とが組み入れられた。研究者らはMRIを用いてこれら2グループの脳梁の大きさおよび形状を評価した。胎児期のアルコールへの曝露は脳梁の発達障害または完全な欠損の大きな原因である。MRIの結果から、アルコールに曝露された小児の脳梁は対照群と比較し有意に薄かった。研究者らはまた拡散強調画像（DWI）を用いて小児の中枢神経系の6領域を調査した。DWIは水の拡散過程をマッピングし、組織異常を検出するのに従来のMRIよりもより感受性の高い方法となり得る。アルコール曝露群の小児は他の群と比較し、DWIにおける拡散が統計学的に有意に多かった。さらに、プロトン磁気共鳴分光法（HMRS）の結果、代謝の変化の複合集積が認められた。

Full Text

Children exposed to alcohol during fetal development exhibit changes in brain structure and metabolism that are visible using various imaging techniques, according to a new study being presented at the annual meeting of the Radiological Society of North America (RSNA).

Alcohol use by expectant mothers can lead to problems with the mental and physical development of their children—a condition known as fetal alcohol syndrome. Research suggests an incidence of 0.2 to 1.5 per 1,000 live births, according to the Centers for Disease Control and Prevention. Costs for care of individuals affected by fetal alcohol syndrome in the U.S. have been estimated at $4 billion annually.

Advancements in magnetic resonance imaging (MRI) are affording unprecedented insights into the effects of alcohol on the central nervous systems of children whose mothers drank alcohol during their pregnancy. Recently, researchers in Poland used three different MRI techniques to better define these effects.

The study group included 200 children who were exposed to alcohol during their fetal stage and 30 children whose mothers did not drink while pregnant or during lactation. Researchers used MRI to evaluate the size and shape of the corpus callosum, the bundle of nerve fibers that forms the major communication link between the right and left halves of the brain, in the two groups. Prenatal alcohol exposure is the major cause of impaired development or complete absence of the corpus callosum.

The MRI results showed statistically significant thinning of the corpus callosum in the children exposed to alcohol compared with the other group.

"These changes are strongly associated with psychological problems in children," said Andrzej Urbanik, M.D., chair of the Department of Radiology at Jagiellonian University in Krakow, Poland.

Dr. Urbanik and colleagues also used diffusion weighted imaging (DWI) to study six areas of the central nervous system in the children. DWI maps the diffusion process of water and can be a more sensitive means than traditional MRI for detecting tissue abnormalities.

Children in the alcohol group exhibited statistically significant increases in diffusion on DWI compared with the other children.

"The increase of diffusion indicates neurological disorders or damage to the brain tissue," Dr. Urbanik said.

To noninvasively study metabolism in the brains of the children, the researchers used proton (hydrogen) magnetic resonance spectroscopy (HMRS), a common adjunct to structural MRI studies. HMRS results showed a complex collection of metabolic changes.

"In individual cases, we found a high degree of metabolic changes that were specific for particular locations within the brain," Dr. Urbanik said.

Coauthors are Teresa Jadczak-Szumi?o, M.Sc., Monica Nardzewska-Szczepanik, M.D., Paulina Karcz, M.Sc., and Justyna Kozub, M.Sc.

TOPICS

Oncology

Psychiatry

アルツハイマー病の性差（Abstract # SSE16-02）

MRIスタディの結果、アルツハイマー病を発症する男性と女性とで灰白質の減少が有意に異なることが示された

MRI study shows pattern of gray matter loss is significantly different in men and women who develop Alzheimer's disease

アルツハイマー病（AD）に伴う局所脳灰白質体積減少の程度と分布は性別に強く影響されると2012年Radiological Society of North America年次集会で発表された。ADの女性は最初に脳萎縮がより顕著であるが、疾患の進行は男性においてより速かった。研究者らはAlzheimer's Disease Neuroimaging Initiativeに参加した患者109人（男性60人および女性49人[平均年齢77歳]）のデータを解析した。5年間のスタディ期間中に109人の患者いずれもが、健忘型MCIからADへと進行した。ADと診断された時点および診断の12か月前および後に施行されたMR画像を用いて、研究者らは灰白質の変化を図示した脳マップを作製した。脳マップから、男性患者と比較し女性患者ではADの診断前12か月および診断時から灰白質の萎縮が著明であった。脳マップからはまた、疾患進行に伴う脳灰白質体積の減少領域は男性と女性とで異なることも示された。

Full Text

All patients with Alzheimer's disease (AD) lose brain cells, which leads to atrophy of the brain. But the pattern of gray matter loss is significantly different in men and women, according to a study presented at the 2012 annual meeting of the Radiological Society of North America (RSNA).

"We found that the extent and distribution of regional gray matter volume loss in the brain was strongly influenced by gender," said lead researcher Maria Vittoria Spampinato, M.D., associate professor of radiology at the Medical University of South Carolina in Charleston.

"There is a strong interest in using magnetic resonance imaging (MRI) to assess brain atrophy with the purpose of monitoring dementia progression noninvasively and to aid in understanding which factors can influence brain atrophy progression and distribution in the Alzheimer's brain," Dr. Spampinato said.

In the study, Dr. Spampinato and colleagues analyzed data on 109 patients, including 60 men and 49 women (mean age 77), who participated in the Alzheimer's Disease Neuroimaging Initiative (ADNI), a major study that followed hundreds of cognitively healthy individuals and individuals with mild cognitive impairment (MCI) and AD over a period of five years.

During the five-year period, each of the 109 patients progressed from amnestic MCI (in which the patient suffers memory loss but maintains cognitive function) to AD. Using MR images of the patients' brains taken when they were diagnosed with AD and 12 months before and after the diagnosis, the researchers created brain maps that illustrated gray matter changes.

The brain maps revealed that compared to male patients, the women had greater atrophy in gray matter 12 months prior to their AD diagnosis and at the time of their diagnosis. The brain maps also showed that the men and women in the study lost gray matter volume in different areas of the brain as their disease progressed from MCI to AD.

"The female patients in our study initially had more gray matter atrophy than the male patients but over time, the men caught up," Dr. Spampinato said. "In the men, the disease developed more aggressively in a shorter period of time."

Dr. Spampinato said the gender differences in atrophy patterns have important implications for the development of therapies for MCI and AD.

"These differences should be taken into consideration when testing new drugs in clinical trials," she said. "Knowing the difference between the male and female patterns of atrophy will help researchers better decipher a patient's response to drug therapy."

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