PANNON-PALATINUS

Téma

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Válasz a Radiológiai Szakmai Kollégium állásfoglalására

(információk, pontosítások, szakirodalmi kivonatok)

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Az interneten évek óta található egy állásfoglalás, amit a Radiológiai Szakmai Kollégium tett fel letörölhetetlenül, melyben a Somatoinfra kutatással szembeni, néhol indulatoktól sem mentes véleményüket fogalmazzák meg. Az állásfoglalás feltételének időpontját nem lehet meghatározni, mert azonosításképpen mindösszesen két áprilisi időpontot lehet csak találni (április 18. és árpilis 26.), a kiadási év feltüntetése nélkül.

Az állásfoglalás szerint igazából csak személyemet éri erőteljes kritika. Tisztelettel pontról-pontra kívánom válaszaimat megadni:

RSZK: „Az elmúlt időszakban a média több ízben (pl.: Népszabadság, április 18., április 26., Info-rádió április 26.) hírt adott a dr. Szacsky Mihály, a BME Nukleáris Technika Tanszék – önmagát „szomatológus"-nak nevező – tudományos munkatársa által kidolgozott, úgynevezett "szomatoinfra" eljárásról, mint széleskörű, átfogó lakossági szűrésre alkalmas módszerről, melyet annak ártalmatlan volta miatt egészségügyi szakképesítés nélkül is lehet végezni a WHO véleménye alapján."

Az idézet azt sejteti, hogy itt minden gyanús és tisztázatlan. Természetesen az állítás, amit személy szerint nekem tulajdonítanak, nem igaz. Lehet, hogy a bulvárlapokból ilyen hangsúllyal kerülnek ki egyes információk, de ezt az állítást, miszerint bárki használhatja, minden, e témával kapcsolatos írásaimban cáfolom. A Somatológia tudományának nem ismerése meglep, mert 1970-es és 1980-as években a Magyar

Tudományos Akadémián Professzor Dr. Nádory László egy Somatikus bizottságot vezetett. Tanulmányaimat a Professzor Úr munkássága áthatotta, és ha szerényen is de, igyekszek valahol a nyomdokaiban haladni.

RSZK: „A módszer részletes fizikai elveit, müködési módját, a megbízhatóságára vonatkozó statisztikai elemzéseket (érzékenység, pontosság, pozitív és negatív prediktív érték,kiszűrtek aránya, betegek aránya a kiszűrtek között, stb.) ismertető közleményeket nem találtunk sem a szakmai publikációk körében, sem egyéb forrásokban."

A határozott állítás meglep, de egyben ellentmondásosságokat is tartalmaz. Mi a kérdés, a fizikai megalapozott tudományos kutatások eredményeinek nem ismerése, vagy az egészségügyi statisztika? A működési elvek lefektetése típusos kutatói feladat, és mint ilyen soha nem képezi a definitív ellátást. A tudományos munka, napjainkban megköveteli az interdiszciplináris elveknek megfelelő csoport munkát. A Radiológus Szakmai Kollégium ezzel a felvetésével tévesztett, mert a célkeresztben nem egy ember áll, hanem fizikusok, biológusok, vegyészek, mérnökök egész hada. A félreértés abból adódhat, hogy személy szerint nem vagyok „feltaláló", nem fejlesztek gépeket, azokkal nem kereskedek. Mint az élettudományok egy meghatározott szegmensében tevékenykedő „természetvizsgáló", értelmezni szeretném az élet olyan folyamatait, amelyekről még keveset, vagy semmit nem tudunk. Kérdéssel fordultam és fordulok a társtudományok szakértőihez és keresek olyan műszaki, méréstechnikai, informatikai stb. megoldásokat, amely segítségével a vélelmezett, de valós folyamatokat nagy pontossággal le lehet mérni. A segítség nem maradt el. Sok tudóstól és szakembertől, a világ szinte minden pontjáról segítséget kaptam. A kezdetben hipotézisek lassan tézissé formálódtak és mindenki számára érthető módon kb. 15 éve mindent leírok. Ebben nem csak egyedül vagyok, mert sok esetben csatlakoznak orvosok, fizikusok és az is előfordul, hogy a témát hallgatók diplomamunkának választják a funkcionális anatómiai képalkotás e sajátos módszerét. A publikálási kényszer és ennek kíméletlen versenye elérte a kutató csoportot is. Minden hazai könyvfejezetemre, könyvemre, folyóirat cikkemre azt a választ kapom, hogy ez nem megfelelő publikáció, annak ellenére, hogy az orvostudományok kandidátusának vagy professzorának könyvébe kerületek írásaim. A számon kért publikációk az orvosi szaklapokban azért nem találhatóak, mert egy szerény próbálkozásnál a szerkesztő közölte, hogy írásaimat soha nem fogják közölni. Többször kaptam olyan ajánlatot, hogy más nevében (elsősorban főorvosok) adjam be írásaimat, mert akkor biztos, hogy meg fognak jelenni dolgozataim. Idegen tollakkal és nevekkel nem ékeskedem. Ezért válaszomban írásaimra nem hivatkozok.

Sajnálatos, hogy egy szakmai kollégium arra hivatkozik, hogy szakirodalmat nem leltek fel egy olyan témába, amit több mint ötven éve kutatnak a világban. Ezért természetesen a teljesség igénye nélkül egy kis szakirodalmi csokrot állítottam össze a mellékletben.

Ezt azért is tettem, mert amikor a humán természetes radiáció kérdéskörén és problematikáján elgondolkodtam (1984), akkor több mint öt éven keresztül, mást sem tettem, mint szakirodalmaztam, és találtam. Ebben az időszakban egy rendező elvnek megfelelően a világban alkalmazott infravörös humán vizsgálatokat három nagy iskola köré lehetett csoportosítani, amelyek a mai napig megállják helyüket. Megállapításaim helyesnek bizonyultak, mert a „három" alkalmazott és kutatott iskola napjainkra sem érett meg arra, hogy a deffinitiv orvos-diagnosztikába helyet kapjon.

Saját kutatásaimat az élettudomány területén folytattam (Biológiai-antropologia, humánbiológia, sporttudomány, teljesítmény élettan, edzéselmélet-módszertan). Ennek megfelelően orvosi statisztikai vizsgálatokat nem végezhetek, nem is szándékoztam soha. Egy módszerről mindösszesen azt állítottam, hogy megfelelő képzés esetében integrálható az orvos-diagnosztikai eljárások sorába. Semmilyen módszert nem vált ki, semmilyen eljárást nem helyettesít, mindösszesen kiegészíti az orvos-diagnosztikai eljárásokat egy olyan eszközzel és módszerrel, amelyel az orvosi műszerpark jelenleg nem rendelkezik. Tehát az orvostársadalmon múlik, hogy milyen módon kívánják a dinamikus fiziológiai folyamatokat reprezentáló módszert, a funkcionális anatómiai képalkotást az orvosdignosztikai eljárások sorába illeszteni.

Tisztában vagyok a nehézségekkel. Azt tapasztalom, hogy orvosok számos esetben minden ismeret nélkül alkalmaznak technikai és elektronikai eszközöket, melyekkel diagnosztizálnak, és terápiás kezeléseket végeznek. A hivatkozás természetesen nem az ismert eljárásokra vonatkoznak. Minden olyan esetben, amikor tudott az, hogy „mit mérünk" és „mivel mérjük", valamint az eljárás természettudományi alapokon nyugszik, akkor biztosak lehetünk az eredmények pontosságába, valamint megbízhatóságába. Az orvosi képalkotás elsősorban vizuális anatómiai megjelenitést alkalmaz, kevés esetben van arra mód és lehetőség arra, hogy méréseket végezzenek. A mérések esetében nem a méretbeli eltérések meghatározását kell érteni A természettudományokkal foglalkozó kutatót zavarja, amikor ezekről az a természettudományi alapokról semmilyen információ nem áll rendelkezésre, mindösszesen csak annyit tudhatunk, hogy biztosak lehetünk az eredménybe, mert a vizsgáltokat és kezelést főorvos végzi. Sajnos egyre többször hallhatunk misztikus energiákról, különleges ingákról, vízerekről, csodálatos molekulákról-hatóanyagokról, rezgésekről stb. Tapasztalatom, hogy ilyen módszerekkel és eszközökkel nem csak varázslók és önmagukat „természetgyógyászoknak" valló laikusok diagnosztizálnak és végeznek gyógyítást, terápiát, hanem egyébként kitűnő orvos szaktekintélyek is „hisznek" ezekbe a módszerekbe. A mindennapi orvosi gyakorlatban erőteljesen kritizálható méréstechnikai módszerek is elterjedtek. Az igazi problémát viszont a merésmódszerekben lehet keresni és találni. A lehető leg gondosabb tanulmányozás esetében sem találunk értelmezhető választ arra, hogy „mit mérnek", „mivel mérnek","mi az információ tartalom". Érdeklődéssel várom, hogy a szakmai kollégium ezeket a valós sarlatánságokat mikor kritizálja meg, és mikor számolja fel. Tisztába vagyok azzal, és vállalom, hogy a Somatoinfra rendszer még nem tart ott, ahol több szak és főorvosok által használt és alkalmazott diagnosztikai módszer. A fizika és kémia tudományok képviselőit hiába kérdem a bio-energetikáról, a betegségek ki ingázásáról, a nem létező molekulák gyógyító hatásairól, térerőkről, somatográfról, vízerekről stb. nem kapok értelmezhető választ. Itt valószínűsíthetően olyan magas orvostudományokról van szó, amihez a humán infravörös emisszió el sem juthat.

RSZK: „A tudósításokban, interjúkban több alkalommal is szó esett – az Országos Tiszti Főorvosi Hivatalra („rövidesen megkezdődik a lakosságszűrés bevezetése"), illetve az Egészségügyi Minisztériumra (forgalomba hozatali engedély, CE jelzés engedélyezése), a Honvédelmi Minisztériumra (katonai alkalmassági vizsgálatok bevezetése), az Országos Sportegészségügyi Intézetre (sportolók gyors állapotfelmérése) való hivatkozás mellett – az ETT „támogatásáról" is. A Radiológiai Szakmai Kollégium növekvő aggodalommal figyeli az eljárással kapcsolatos sajtókampányt, illetve az ebben hivatkozott hivatalos támogatást. Rendkívül sajnálatosnak tartjuk, hogy egy, a humán egészségügyi ellátásban alkalmazni kívánt képalkotó eljárással az egészségügyben dolgozó szakértők szenzációhajhász módon, a médiumokból hallanak először, ami egyrészt nem túl etikus eljárás, másrészt azt a benyomást kelti, hogy a módszer kidolgozói esetleg nem szívesen vállalnák az ilyenkor szokásos, a szakmai közvélemény keretei között lefolytatott objektív vitát és megmérettetést."

A pontosítás érdekében célszerű a Műegyetemi kutató csoport néhány említett intézménnyel való kapcsolatáról szót ejteni. Az ETT (Egészségügyi Tudományos Tanács) engedélyekre azok az orvosok hivatkoznak, akik megtévesztő módon az alapvető szakmaiságot sem betartva használják a Somatoinfra nevet. A Műegyetemi Természettudományi Kar 2002-ben, hogy meggyőződjön arról, hogy a kutatások jó irányba haladnak egy rövid összefoglalóban a természettudományi kutatásokról tájékoztatta az Egészségügyi Tudományos Tanácsot. A Műegyetemi Természettudományi Kar és a Műegyetemi Természet és Sporttudományi Közhasznú Egyesület egy összefoglaló tanulmányt nyújtott be a Magyar Tudományos Akadémia Egészségügyi Tudományos Tanácsához, és az elvégzett kutatómunkáról beszámolót készített. A Műegyetem Természettudományi Karhoz érkező ETT véleményben az ETT azt írja le, hogy a benyújtott kutatási anyagok és eredmények alapján a „természettudományi kutatások lezártnak tekinthetők", valamint javaslatot tesz a tudományos tanács arra vonatkozólag, hogy a jövőben mely, az orvostudományhoz illeszthető tevékenységével bővítse ki a kutatócsoport működését. Az ajánlásnak megfelelően a kutatócsoport jelenleg is ennek a szellemiségében tevékenykedik, ami nem jelenti azt, hogy a természettudományi kutatásokat orvostudományi kutatásokra váltotta volna. A somatologiai (humánbiológiai, antropológiai, kvantumbiológiai stb.) kutatások csak komplex szakmai együttműködéssel valósíthatók meg. A magas szintű szakmai kutatómunkát hivatott biztosítani pl. a Budapesti Műszaki és Gazdaságtudományi Egyetem Rektora és az Országos Tisztiorvosi Hivatal Országos Tiszti-főorvosa által (2008) aláírt kutatási együttműködési szerződés is.

(eredeti dokumentumok irattárban)

Alapvetően a kezdetekben a sporttudományi kutatásokhoz igyekeztünk megfelelő nagysebességű teljesítmény élettani kutatásokhoz is használatos műszert keresni. Ennek megfelelően az elmúlt évtizedekben a sporttudományi kutatásokban eredményeket könyvelhetünk el úgy hazai, mint nemzetközi szinten. A Honvédelmi Minisztérium 2003-ban írta ki a „Haderőreform 2005" pályázatot. A pályázaton a kutatócsoport más kutatóhelyekkel közösen nyert, a kutatást elvégezte és leadta. Minden bírálatban jó véleményt mondtak a kutatási eredményekről. A természettudományok területén nehezen értelmezhető, ami az idézetben szerepel „objektív vitát és megmérettetést". Miről kellene vitázni? Hogy mi az, hogy elektromágneses sugárzás, vagy, hogy mi az, hogy optikai leképezés, vagy arról, hogy mi a hőmérséklet mérés és az emittálódó relatív infravörös sugárzás intenzitása közötti különbség, vagy mit jelent a spektrális analízis. Módszerünk természetesen nincs olyan színvonalon, mint az orvostudomány. A kutatásoknál mindösszesen csak arra figyelünk, hogy tudjuk, hogy mit mérünk, mivel mérjük – milyen pontossággal –, valamint keressük, az objektív leképezésben milyen információ mennyiség található. Csodálattal szemléljük azokat a mindennapokban orvosok által alkalmazott különleges diagnosztikai rendszereket, amelyek esetében a három kérdésfelvetésre csak homályos válaszokat kapunk. A somatoinfra még nem teljesítette ezeket az elvárásokat, és nagyon messzi vagyunk attól, hogy „kompjúteres" elemzés kiválthatná a tudást.

RSZK: Aggodalmunk okai a következők: Eddig nem állt módunkban találkozni a „szomatológia" tudományával, illetve e tudomány egyetlen képviselőjével sem. Az internetes keresés alapján megállapítható, hogy ismerethiányunk nem véletlen, a csekély számú találat az ezoterikus áltudományok körében mutatkozott.

Ez a három mondat nagyon elbizonytalanít. Gondolom, hogy az egészség frontján helytálló orvosoknak nincs arra ideje, hogy elmélyült interdiszciplináris szakirodalmakat gyűjtsenek és dolgozzanak fel. Ezt a mellékletben igyekszem pótolni, és segítséget kívánok nyújtani a további, remélhetőleg kialakuló gyümölcsöző közös munkához. Az előző mondatokból is csak bulvárlap értesülésekkel találkozhatunk. Korábbi írásaim egyikét sem „szedték darabokra".

Zavarom ott alakult ki, hogy egy orvosi szakmai kollégium egyetlen tagja sem tudja mi az, hogy „szomatológia". Távolról sem szeretnék nyelvészkedni, de a soma görög szó, és testet jelent. Ezzel a mindennapi orvoslásban úgy találkozhatunk, hogy „pszicho-somaticus" betegségek. Igaz, amikor a fordítottját mondom, somato-pszichés folyamatok, akkor sokan zavarban vannak, és **Evidence-based medicine igazolásokat** követelnek.

Létezik néhány könyv vagy dokumentum, amely szinte minden orvosi rendelőben megtalálható. Természetesen nem kívánok hivatkozni biológiai antropológiai, szomatotipizálással foglalkozó stb. könyvekre, de még lexikonra sem.

Az Akadémia Kiadó (Budapest) többszöri kiadásban jelentette meg:

Brencsán János: Új Orvosi Szótár (orvosi kifejezések magyarázata) könyvét.

A 475. oldalon a második oszlop harmadik bekezdésében a következő olvasható:

„szomatológia a testtel, mint élő szervezettel (annak anatómiájával, élettanával) foglakozó tudományág"

Tudom, hogy hibát követtem el, amikor erre a tudományra adtam fejemet. Gondos szakirodalmazás szerint sem találtam viszont ezoterikus utalásokat. Lehet, hogy forrásainkat más-más helyen keressük. Több országban jól felszerelt szomatológiai kutatóintézetek működnek. Miután tisztába vagyok azzal, hogy csak az amerikai tudomány számít hazánkban ezért értelem szerűen a Harvard University sportélettani laboratóriumában kidolgozott indexet említem.

RSZK: Évtizedek óta ismert a termográfia nevű eljárás, amelynek lényege, hogy azemberi test, vagy egyes testrészek hőtérképe (infravörös kisugárzásának megjelenítése) alapján próbál következtetéseket levonni az egyes szervek működéséről. A „szomatoinfra" eljárás kísértetiesen emlékeztet az úgynevezett tele-termográfiára, amellyel kapcsolatban a legfontosabb tapasztalat az, hogy nem képes kellő megbízhatósággal jelezni és kizárni az egyes, a bőrfelszín alatt mélyebben elhelyezkedő szervek kóros eltéréseit. A megjelent hírekből nem derül ki, mennyiben képes az „új" eljárás többletinformációt nyújtani a korábban diszkreditálódott módszerhez képest.

Zavarom csak tovább fokozódik. A radiológiai szakmai kollégiumnak úgy tűnik, csak hallomásból vannak ismeretei a módszerről. A telethermográfiát sem ismerik. Ezért a mellékelt kivonatos szakirodalom tanulmányozását ajánlom. A szakirodalmak között csak a három feldolgozott iskola módszere található. Sajnos a fejlesztéseinket röviden bulvárlapokba nem tudom megírni, az egészségügyi lapokból kizártak ezért csak azt tudom mondani, hogy tudunk valamit, és aki kíváncsi rá szívesen elmondjuk. Egyet nem tudunk megtenni. Nem tudunk varázseszközöket adni, nem értünk a kereskedelemhez, a marketinghez és a pácienscsalogatáshoz.

RSZK: Bárhogyan is működik a „szomatoinfra", a képalkotó diagnosztikai módszerek bevezetését – az orvos-szakmai szabályoknak megfelelőn – hosszú klinikai vizsgálatoknak kell megelőzni, hogy a nemzetközileg elfogadott elveknek, az ún. „evidence based medicine" feltételeinek megfeleljen. Ez alól nem jelent felmentést a módszer fizikai ártalmatlansága sem. A szűrő módszerekkel kapcsolatban további, rendkívül szigorú szakmai feltételrendszer létezik, amelynek teljesülnie kell minden új eljárás Szűrű vizsgálatként való alkalmazása esetén. A szűrés megkezdése előtt definiálni kell azt a betegségcsoportot, amelyre szűrni kívánunk (hiszen nincs olyan módszer, amely minden ember minden betegségét képes kimutatni), meg kell határozni a kiemelés kritériumait, és igazolni kell, hogy egyrészt a kiemeltek között valóban gyakrabban fordul elő a kérdéses betegség, másrészt biztosnak kell lenni abban, hogy a nem kiemelt (negatív) csoportban ez a betegség valóban kizárható. Ezen feltételek igazolásához igen nagy betegcsoporton randomizált, prospektív vizsgálatsorozatot kell végezni, amelynek eredményeit objektív statisztikai analízisnek kell alávetni. Nem tudunk arról, hogy a „szomatoinfra" eljárás átesett volna-e ilyen kipróbáláson, azt azonban tudjuk, hogy a tele-termográfia ezen a próbán megbukott.

Az állításokkal természetesen egyetértek, és biztosak lehetünk abban, hogy ezek a szigorú vizsgálati sorok a betegek esetében nagyon fontosak. Mint korábban említettem, az első megközelítésben – és napjainkban is – sem betegségdiagnosztizálással, sem betegellátással nem foglalkoztunk, foglalkozunk. A WHO ennek megfelelő idézetét is célszerű beemelni.
Idézet:

„Szűrés (screening): A korai szakaszban lévő, nem diagnosztizált betegség, elváltozás valószínűsített azonosítása gyorsan kivitelezhető tesztek és egyéb vizsgálati eljárások alkalmazásával. A szűrés elkülöníti a látszólag egészséges személyeket valószínűleg beteg, illetve valószínűleg nem beteg személyek csoportjára. A szűrés nem diagnosztikus eljárás. A pozitív vagy bizonytalan szűrési eredményű személyek további orvosi kivizsgálása szükséges a korai diagnózis és szükség esetén az azonnali kezelések érdekében… A szűrővizsgálatok többféle típusát szokás megkülönböztetni: -Tömeges szűrővizsgálatok (mass screening) – multi fázisos vagy többirányú szűrővizsgálat, valamint előírt szűrővizsgálat…"

Ennek értelmében és a szakmai kollégium leírása szerint országunkban csak beteg emberek vannak. Az egészséggel és az egészség fenntartásával senki nem foglalkozik. Minden embernek jogában áll megtudni, hogy kornak-nemnek megfelelően milyen egészségi állapotnak örvend és milyen módszerrel, életvitellel, életmóddal tudja azt fenntartani. A Műegyetemi kutatócsoport ez utóbbi szellemiségnek megfelelően végzi kutatásait, melyet az Antropológiai szemlélettel tudunk legjobban jellemezni. Számomra teljesen értelmezhetetlen, hogy egészségesnek mondott embereket azért, hogy betegségeket találjanak rajtuk, miért kell szakorvosi invazív szűrővizsgálatok alá vetni. A szomatológiai és a szomatoinfra kutatások (mindig is hangoztattuk) csak preklinikai, prediagnosztikának számítanak. Riadtan látjuk, hogy orvosok milyen felelőtlenül diagnosztizálnak SOMATOINFRÁVAL tumorokat és mindenféle betegségeket, amiket persze azonnal gyógyítani kezdenek. Ez nem a mi világunk. Kutatásaink sorában eljutottunk odáig, hogy egyes meghatározható területeken a módszert javasolni tudjuk szakorvosi rendszerbe állításra is. Ezek jelenleg még kutatási szakaszban vannak, mert nincs olyan orvos szakmai terület, ahol megismerve a lehetőségeket, elkezdik azt a munkát végezni, amit a kollégium tőlünk kér számon.

RSZK: A klinikai kipróbálás előtti, kísérleti fázis finanszírozása nem származhat sem a betegellátásra, sem a szűrővizsgálatokra szánt forrásokból (OEP, ÁNTSZ). A vizsgálatok ezen szakaszában a forrásokat a tudományos kutatások esetében szokásos módon, pályázati, K+F pénzek felhasználásával kell elvégezni, majd – az eredmények hazai és nemzetközi szakmai fórumokon történ_ publikálása, megmérettetése után – a megfelelő evidenciák megalapozása után lehet mód a klinikai kísérleti fázis lefolytatására. A betegségek felderítésére irányuló szűrővizsgálatok az egészségügyi tevékenység kategóriájába tartozó, megfelelő szakképesítéshez kötött eljárások, e feltétel alól sem a WHO, sem más nem adhatott és – ismereteink szerint nem is adott – felmentést. A megfelelő szakképesítés híján végzett egészségügyi tevékenységet joggal tekinthetjük kuruzslásnak.

A fejezet első része teljesen érthető. Minden olyan kutatás, amelyik köthető az orvosi tevékenységhez ott a pénz is csak orvos csoporthoz mehet. Ezzel nincs semmi probléma, mert ezeket a kutatásokat önmagunk finanszíroztuk, illetve külföldi kutatócsoportok felkérésére végeztük. Bizonyítottan orvostól pénzt nem vettünk el. Mivel valószínűsíthetően körlevélben is kizártak minket a publikálásból ezért ennek az adminisztratív kötelezettségnek nem tudunk eleget tenni. Ettől még a csoport minden tagja járja a világot, konferenciákon tartunk előadásokat, közös munkákat végzünk, és a diszkrimináció miatt saját magunknak publikálunk. Senkire nem erőltetünk semmit, mint egyes vállalkozók és kereskedők, mert nincs mit eladni. Csak a tudásunkkal rendelkezünk, aki kíváncsi rá annak átadjuk, de köszönjük szépen, önmagunk boldogságára is képesek vagyunk kutatni, főleg, ha az eredményes. Az utolsó mondattal szeretnék vitába szállni. Ennek az állításnak az a lényege, hogy az, aki papírral rendelkezik (adott esetben orvosi diplomával), mindent csinálhat. Az elmélet kifogástalan, és ennek megfelelően az összetett élettudományi területnek oktatására mindig is nagy hangsúlyt helyeztünk. Ez természetesen nem egy BT, vagy KFT akadémia. Az viszont nagyon zavarja a természettudományok szerény ismerőit, hogy a papírral rendelkező orvosok mindent megtehetnek. Az infravörös képalkotásról teszek csak említést, mert ebben a témakörben lettem kipellengérezve. A Radiológiai Szakmai Kollégium természetesen nem tekinti kuruzslásnak azt, amikor egy klinika a „NASA által fejlesztett hő kamerás vizsgálatokat" hirdet, természetesen fonendoszkóppal a nyakban. A televízióban látható színes „pacák" már nem is megmosolyogtatóak, hanem egyszerűen felháborítóak, mindazon túl, hogy minden valótlan. Igaz nem kritizálhatóm az ott dolgozó főorvosokat, mert papírjuk van róla, de legalább valaki szóljon, hogy radírozzák ki a képen látható emberen mért hőmérsékletet, ugyanis az ott vizsgálat emberek zöme 7,5–11 °C értéket mutatnak. Gyűjteményem van arról, hogy milyen megtévesztő módon, rosszul plagizálva, milyen varázslásokat végeznek az infravörös monitorozással.

Figyelmébe ajánlom a Radiológus Szakmai kollégiumnak azt a megállapításunkat, hogy egy mérőműszer az csak maximum 20%-ban fontos. De ebbe a 20%-ba minőségi, kalibrált és célra fejlesztett eszközt kell érteni. A somatoinfrát jelen szerény ismeretink szerint nem lehet másra bízni, csak arra, aki komplexitásába megismerte a módszert. Napjainkban az a szokás, hogy mindenféle sugárzásmérőkkel, műszerekkel árasztják el az orvosokat, akik hajlanak arra, hogy csak be kell kapcsolni egy berendezést és akkor az automatikusan működni képes. Azt a sánta érvelést is említhetném, hogy hiába van mester hangszerem, ha botfülű vagyok, és nem tudok zenélni.

RSZK: Ezen levelünket a szükséges intézkedések megtétele céljából, illetékességből megküldjük az egészségügyi miniszternek, az ETT elnökének, az Országos Tiszti Főorvosnak, az OEP főigazgatójának és helyettesének, a Magyar Honvédség egészségügyi szolgálata parancsnokának, a Budapesti Műszaki és Gazdaságtudományi Egyetem rektorának, az EüM egészségpolitikai főosztály vezetőjének, egyúttal felajánljuk szakmai tapasztalatainkat és tudásunkat a felvetett kérdések megnyugtató tisztázása, megválaszolása érdekében.

Dr. Palkó András
tanszékvezető_ egyetemi tanár
a Radiológiai Szakmai Kollégium elnöke

Pontosan nem tudjuk, mikor íródott a levél, és mióta olvasható. Az biztos, hogy visszavonultan kutatásainkat igyekszünk folytatni. Azt tapasztaljuk, hogy egészségügyi intézményekkel, hivatalokkal, szervezetekkel, orvoscsoportokkal együttműködésünk töretlen, sőt biztató előrelépések történtek. Azt is meg kell említeni, minden dicsekvés nélkül, hogy a nemzetközi érdeklődés a 2004. évi UNESCO infra konferencia óta folyamatosan növekszik.

Természetesen, mint kutatók, mi is örömmel vennék azokat a szakmai tapasztalatokat és tudást, amit a kollégium felkínált a hatóságoknak. Ez az utolsó mondat azt sejteti, hogy a radiológiai szakmai berkekben intenzív kutatás folyik az infravörös technológiával. Nincs nagyobb vágyunk, mint ezt megismerni.

Úgy tűnik, hogy a 2010. év áttörést jelentett az egészségügyi ellátásban a Somtoinfra területén (megjegyzem, hogy a Somatoinfra védjegy, és szabadalmi oltalommal rendelkezik, melyet az orvostársadalom gyakorlatilag nem vesz figyelembe, ami folytatólagosan fogyasztóvédelmi kérdéseket is felvet).

Tavasszal, valószínűsíthetően a Radiológiai Szakmai Kollégium jóváhagyásával egy „szűrővizsgálati autóbusz" idult körútra az ANTSZ és a Korházszövettség jóváhagyásával. A kezdeményezés nemes cél, a szépséghibája az, hogy ebben a szűrőbuszban egy Somatoinfra berendezés is található, amiről annyit lehet tudni, hogy a „legmodernebb berendezés" (állításaik szerint, szerintünk egy BUHU-1-es berendezésről van szó, ami orvostechnikai engedély nem adható ki), mert a vizsgálathoz le sem kell vetkőzni? Csak egy fej-felvételéből minden betegséget megállapítanak? Bámulatos, hogy az orvostudomány hol tart, de ez nem Somatoinfra.

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194. **Breast thermography and cancer risk prediction. Gautherie M, Gros CM**.
Thermography makes a significant contribution to the evaluation of patients suspected of having breast cancer. The obviously abnormal thermogram carries with it a high risk of cancer. This report summarizes the results of patients with questionable or stage Th III thermograms. From approximately 58,000 patients, most of whom had breast complaints, examined between August 1965 and June 1977, the conditions or a group of 1,245 women were diagnosed at initial examination as either normal or benign disease by conventional means, including physical examination, mammography, ultrasonography, and fine needle aspiration or biopsy, when indicated, but nevertheless categorized as stage Th III indicating a questionable thermal anomaly. Within five years, more than a third of the group had histologically confirmed cancers. The more rapidly growing lesions with shorter doubling times usually show progressive thermographic abnormalities consistent with the increased metabolic heat production associated with such cancers.
Thermography is useful not only as a predictor of risk factor for cancer but also to assess the more rapidly growing neoplasms.

195. Breast thermography is a noninvasive prognostic procedure that predicts tumor growth rate in breast cancer patients

J. F. Head, F. Wang and R. L. Elliott Elliott Mastology Center, Baton Rouge, Louisiana 70816.

Our recent retrospective analysis of the clinical records of patients who had breast thermography demonstrated that an abnormal thermogram was associated with an increased risk of breast cancer and a poorer prognosis for the breast cancer patient. This study included 100 normal patients, 100 living cancer patients, and 126 deceased cancer patients. Abnormal thermograms included asymmetric focal hot spots, areolar and periareolar heat, diffuse global heat, vessel discrepancy, or thermographic edge sign. Incidence and prognosis were directly related to thermographic results: only 28% of the noncancer patients had an abnormal thermogram, compared to 65% of living cancer patients and 88% of deceased cancer patients. Further studies were undertaken to determine if thermography is an independent prognostic indicator. Comparison to the components of the TNM classification system showed that only clinical size was significantly larger ($p = 0.006$) in patients with abnormal thermograms. Age, menopausal status, and location of tumor (left or right breast) were not related to thermographic results. Progesterone and estrogen receptor status was determined by both the cytosol-DCC and immunocytochemical methods, and neither receptor status showed any clear relationship to the thermographic results. Prognostic indicators that are known to be related to tumor growth rate were then compared to thermographic results. The concentration of ferritin in the tumor was significantly higher ($p = 0.021$) in tumors from patients with abnormal thermograms (1512 +/- 2027, n = 50) compared to tumors from patients with normal thermograms

(762 +/- 620, n = 21). Both the proportion of cells in DNA synthesis (S-phase) and proliferating (S-phase plus G2M-phase, proliferative index) were significantly higher in patients with abnormal thermograms. The expression of the proliferation-associated tumor antigen Ki-67 was also associated with an abnormal thermogram. The strong relationships of thermographic results with these three growth rate-related prognostic indicators suggest that breast cancer patients with abnormal thermograms have faster-growing tumors that are more likely to have metastasized and to recur with a shorter disease-free interval.

196. Computerized breast thermography: study of image segmentation and temperature cyclic variations

Authors: E. Y. K. Ng a; Y. Chen a; L. N. Ung a

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197. Computerized detection of breast cancer with artificial intelligence and thermograms

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198. Computed tomography in detection and diagnosis of breast cancer

C. H. Joseph Chang, MD **1 ***, Justo L. Sibala, MD **1**, Steven L. Fritz, PhD **1**, Samuel J. Dwyer III, PhD **1**, Arch W. Templeton, MD **1**, Fritz Lin, MD **2**, William R. Jewell, MD **3**

Department of Diagnostic Radiology, University of Kansas Medical Center, Kansas City, Kansas

Palpable solid breast masses: retrospective single- and multimodality evaluation of 201 lesions

PA van Dam, ML Van Goethem, E Kersschot, J Vervliet, IB Van den Veyver, A De Schepper and P Buytaert Department of Obstetrics and Gynecology, Antwerp University Hospital, Edegem, Belgium.

The diagnostic virtues and limitations of single- and multimodality testing in the evaluation of solid palpable **breast** masses were studied. Two hundred one consecutive patients who had a solid palpable **breast** mass and who underwent biopsy between September 1982 and July 1986 were included for blinded retrospective analysis of their physical examination, mammographic, ultrasonographic (US), thermographic, and pathologic characteristics. Benign **breast** disease was diagnosed histologically in 106 women, while carcinoma was established in 95. The sensitivities of physical examination, mammography, US, and **thermography** were 0.88, 0.94, 0.78, and 0.49, respectively. US alone had the highest sensitivity in correct diagnosis of a benign solid **breast** mass and had the highest accuracy (0.84). Use of four modalities increased the preoperative diagnostic true-positive rate to 0.97, with some decline in specificity. Multimodality testing seems particularly beneficial in pre- and perimenopausal patients.
http://radiology.rsnajnls.org/cgi/content/abstract/166/2/435

Imaging of the radiographically dense breast

199. VP Jackson,

Imaging of the radiographically dense breast

VP Jackson, RE Hendrick, SA Feig and DB Kopans Department of Radiology, Indiana University Medical Center, Indianapolis. Despite recent improvements in mammography equipment and technique, the radiographically dense **breast** remains difficult to image. The problems in imaging the dense **breast** account for a large percentage of the cases of mammographically "missed" carcinomas. Other imaging modalities--such as ultrasonography, transillumination, **thermography**, computed tomography, magnetic resonance imaging, and radionuclide imaging--have been investigated for use in **breast** cancer detection. This overview discusses the current problems associated with imaging of the radiographically dense **breast** and suggests some avenues for investigation to develop solutions to these problems.

Diagnosis of breast carcinoma. An evaluation of clinical examination, mammography, thermography and aspiration biopsy in breast disease.Bjurstam N, Hedberg K, Hultborn KA, Johansson NT, Johnsén C.

200. **Microwave thermography: principles, methods and clinical applications. Myers PC, Sadowsky NL, Barrett AH**. We review the physical principles, method of operation, measurement limitations, and potential medical applications of microwave thermography. We present detailed results of a study of breast cancer detection at 1.3 and 3.3 GHz, including the dependence of detection rates on microwave frequency, time, tumor depth, and tumor size. At 1.3 GHz, microwave thermography detects breast cancer as well as infrared thermography (true-positive rate = 0.76 when true-negative rate = 0.63). When the two methods are combined, the true-positive rate increases by about 0.1 over that of either method alone

201. **Title** Breast Cancer Detection: Mammography and other methods in breast imaging, second edition

202. Thermography of the female breast: a five-year study in relation to the detection and prognosis of cancer

CH Jones, WP Greening, JB Davey, JA McKinna and VJ Greeves

More than 12,000 women have been examined thermographically in the Breast Unit of the Royal Marsden Hospital, London. Of these women 1,464 had biopsy and histology; 363(25 per cent) were found to have carcinoma and of these 68 per cent had abnormal thermograms, 13 per cent has some thermal asymmetry of doubtful significance and 19 per cent had normal thermal patterns. Fifty-seven per cent and 62 per cent of patients with Stage I and Stage II cancer, respectively, had abnormal thermograms whereas 83 per cent of patients with Stage III cancer had abnormal thermograms. Of 1,101 women who had benign lesions, 63 per cent had normal thermal patterns, 15 per cent had thermal asymmetry of doubtful significance and 22 per cent hadabnormal thermograms. The subsequent histories of 172 cancer patients examined thermographically have been analysed and three-year survival rates have been correlated with thermography report, the clinical stage of the disease and the histotogical grade (Bloom, 1950) of the excised tumour. The mean three-year survival rates for patients with Stage II or Stage III cancer are 84 per cent for those with normal and 61 per cent for those with abnormal thermograms.

203. Effect of blood flow, tumour and cold stress in a female breast: a novel time-accurate computer simulation

Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine Professional Engineering Publishing 0954-4119

Volume 215, Number 4 / 2001 10.1243/0954411011535975 393-404

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Abstract

Breast cancer is a dreadful disease among women and early detection helps in achieving a cure. The mammogram is presently the standard tool for detecting breast abnormality, but its sensitivity is lower for women with dense breasts. It has been found that women with an abnormal thermogram are at a higher risk and have a poorer prognosis. However, performing and interpreting thermograms requires meticulous training. Computer simulations can be an additional tool to help the clinician in the interpretation. In this paper, a novel and flexible finite element model of a female breast is developed. Both steady state and time-dependent solutions are obtained. Steady state solutions globally match experimental thermographic results with theproper choice of blood perfusion source terms, tissue thickness and geometric scaling factor. Although the simulations may not be useful in providing a unique solution (i.e. exact size and location of the tumour owing to the complex physiological relationship between the tumour and the breast surface temperature), it would nevertheless help in the 'analysis by elimination'. An example of this type of analysis is also presented.

Nonmammographic breast imaging techniques. Heywang-Köbrunner SH. Klinikum Grosshadern, University of Munich, FRG. Significant progress in early detection of malignancy has been achieved by the improvement of mammographic technique, the introduction of quality control, the demonstration of benefits from screening, and appropriate application of supplementary methods such as ultrasound, cytology, and stereotaxis. Certain problems in breast imaging, however, are still unsolved. These include early detection and exclusion of malignancy without microcalcifications in mammographically dense tissue (particularly in younger women), the still-limited accuracy of mammographic signs, and the management of diagnostic problems after surgery, radiation therapy, or silicone implants. Therefore, research is needed to further improve diagnostic capabilities. The research can be subdivided into different approaches: 1) further development of the mammographic technique (digital luminescence radiography); 2) evaluation of techniques that image other physical tissue properties (sonography, thermography, trans-illumination, CT, non-contrast-enhanced MR imaging, biomagnetism, biostereometry, and ductoscopy); 3) investigation of techniques that image metabolic changes (MR spectroscopy, positron-emission tomography) or metabolism-induced differences in perfusion or vascularity (Doppler ultrasound, contrast-enhanced MR imaging); and 4) development of techniques that attempt tissue diagnosis using monoclonal antibodies. Among these techniques, digital luminescence radiography and contrast-enhanced MR imaging are the most developed and the most promising. They are at the threshold of becoming clinically important. Doppler ultrasound could be useful for certain indications. Whereas MR spectroscopy, positron-emission tomography, the search for appropriate antibodies, and possibly transillumination, ductoscopy, and biomagnetism offer interesting new aspects for research, the value of CT, thermography, and biostereometry is not yet established.

204. The calculation of skin temperature distributions in thermography

Janet W Draper *et al* 1971 *Phys. Med. Biol.* **16** 201-211 doi:10.1088/0031-9155/16/2/301

Janet W Draper and J W Boag Department of Physics, Institute of Cancer Research, The Royal Marsden Hospital, Fulham Road, London, SW3, England **Abstract.** Before calculating the thermal patterns arising from buried heat sources, the factors which control heat loss from the skin and heat transport within tissue are first reviewed and the relevant thermal constants estimated. The various modes of heat loss from the skin seem to be adequately approximated by Newton's law. Temperature distributions due to conduction from veins and tumours are then derived, using line-source and point-source models respectively. Print publication: Issue 2 (April 1971) Received 29 May 1970

205. The Breast Journal Volume 9 Issue 4 Page 341-343, July 2003 **To cite this article:** Eddie Yin-Kwee Ng, Sai-Cheong Fok (2003) A Framework for Early Discovery of Breast Tumor Using Thermography with Artificial Neural Network The Breast Journal 9 (4), 341–343. doi:10.1046/j.1524-4741.2003.09425.x

A Framework for Early Discovery of Breast Tumor Using Thermography with Artificial Neural Network

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206. BREAST THERMOGRAPHY

HAROLD J. ISARD M.D.1 and RUTH SHILO M.D.2 1 Chairman, Division of Radiology 2 The Ichilov Municipal Hospital, Department of Radiology, Tel-Aviv, Israel The thermographic pattern of the human female breast in health is sufficiently constant so that it can be readily identified in an individual not only from week to week during the menstrual cycle, but actually from year to year. There is frequently a dissimilarity in the patterns of the two breasts of an individual. In only half of the cases studied was there an indication of correlation of the thermogram with the phase of the menstrual cycle. The question is posed whether the establishment of a baseline thermogram might be important for comparison purposes at a future time for either an annual breast survey or examinations for clinical symptoms.

Detection of early breast cancer: an overview and future prospects. Zhou XH, **Gordon R**. Department of Electrical Engineering, University of Manitoba, Winnipeg, Canada. Detection and treatment of breast cancer at an early stage is the only method with proven potential for lowering the death rate from this disease. Detection of early breast cancer is promoted by the American Cancer Society, American College of Radiology, and Canadian Association of Radiologists by encouraging the regular use of three types of screening: breast self-examination, clinical breast examination, and mammography. When all factors are considered, it has been convincingly demonstrated that the potential benefits of mammography far outweigh the minimal, clinically undetected radiation risk incurred by the examination. New technologies, such as computed tomography, magnetic resonance imaging, transillumination diaphanography, ultrasound, thermography, and digital subtraction angiography might offer a wide selection for patient examination. However, none of these procedures, in its present form, is expected to replace mammography as the first-line imaging technique for the detection and diagnosis of benign and malignant breast lesions. Breast cancer is detected now, in most cases, via casual or informed breast self-examination. This first-line of detection is not sufficient, since most tumors may metastasize before they reach a palpable size. Mammography generally shows up tumors no smaller than 1-cm diameter, which in many cases have already metastasized. The more advanced imaging modalities in their current forms suffer from a number of drawbacks that give them a lower overall detection rate than mammography. Understandably, improving breast imaging modalities is a great challenge to diagnostic radiology. The purpose of this article is to provide a comprehensive overview of the detection of early breast cancer. It briefly discusses the understanding of breast cancer, its incidence, and the mortality and survival of patients with breast cancer, as well as screening programs for breast cancer. We review the developments in mammography and other breast imaging modalities over the last several years. Prospects for digital mammography, digital image enhancement, and three-dimensional digital subtraction mammography, which may someday supplant film mammography, are also discussed.

207. Numerical computation as a tool to aid thermographic interpretation

Authors: E. Y. K. Ng; N. M. Sudharsan **DOI:** 10.1080/03091900110043621 **Publication Frequency:** 6 issues per year

Published in: Journal of Medical Engineering & Technology, Volume 25, Issue 2 March 2001 , pages 53 - 60 **Formats available:** PDF (English)

Abstract Thermography is an non-invasive and a painless tool for the detection of breast cancer. However, performing and interpreting thermograms requires meticulous training. It was found that women with an abnormal thermogram are at a higher risk and have a poorer prognosis. One of the main drawbacks of the thermogram is the high incidence of false-positive results. The authors believe that the fault lies in misinterpretation of the thermogram, rather than the thermogram itself. The paper aims to show that computer simulations could be an adjunct tool to help the clinician in the interpretation. This would greatly reduce the false-positive diagnosis.

208. Microwave thermography in the detection of breast cancer

AH Barrett, PC Myers, and NL Sadowsky

Microwave thermography, a method of sensing subcutaneous temperatures, was used in a breast cancer detection study of about 5,000 female patients. The data were taken at wavelengths of 9.1 and 23 cm. Microwave thermography at 23 cm has true-positive and true-negative detection rates of 0.8 and 0.6, respectively, comparable to those of infrared thermography (0.7) and inferior to those of xeromammography (0.9). However, a potential advantage results if microwave and infrared thermography are used together for screening, and if mammography is used only for follow-up on those patients who were positive on either the microwave or the infrared thermograms. It is then possible to obtain true-positive and true-negative detection rates of 0.9 and 0.9, respectively, while only half the number of patients need be subjected to x-rays. http://www.ajronline.org/cgi/content/abstract/134/2/365

209. Circadian

Circadian rhythm chaos: a new breast cancer marker. Keith LG, **Oleszczuk JJ**, **Laguens M**. Department of Obstetrics and Gynecology, Northwestern University Medical School, Chicago, Illinois, USA. The most disappointing aspect of breast cancer treatment as a public health issue has been the failure of screening to improve mortality figures. Since treatment of late-stage cancer has indeed advanced, mortality can only be decreased by improving the rate of early diagnosis. From the mid-1950s to the mid-1970s, it was expected that thermography would hold the key to breast cancer detection, as surface temperature increases overlying malignant tumors had been demonstrated by thermographic imaging. Unfortunately, detection of the 1-3 degrees C thermal differences failed to bear out its promise in early identification of cancer. In the intervening two-and-a-half decades, three new factors have emerged: it is now apparent that breast cancer has a lengthy genesis; a long-established tumor-even one of a certain minimum size-induces increased arterial/capillary vascularity in its vicinity; and thermal variations that characterize tissue metabolism are circadian ("about 24 hours") in periodicity. This paper reviews the evidence for a connection between disturbances of circadian rhythms and breast cancer. Furthermore, a scheme is proposed in which circadian rhythm "chaos" is taken as a signal of high risk for breast cancer even in the absence of mammographic evidence of neoplasm or a palpable tumor. Recent studies along this line suggest that an abnormal thermal sign, in the light of our present knowledge of breast cancer, is ten times as important an indication as is family history data.

210. THERMOGRAPHY IN MASS SCREENING OF CANCER: SUCCESS AND FAILURES

Harold J. Isard1

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Annals of the New York Academy of Sciences Volume 335 Thermal Characteristics of Tumors: Applications in Detection and Treatment Page 429-437, March 1980 **To cite this article:** Tom J. Love (1980) THERMOGRAPHY AS AN INDICATOR OF BLOOD

PERFUSION Annals of the New York Academy of Sciences 335 (1), 429–437.
doi:10.1111/j.1749-6632.1980.tb50766.x

211. Prev Article

THERMOGRAPHY AS AN INDICATOR OF BLOOD PERFUSION

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The thermal scanning of a curved isothermal surface: implications for clinical thermography

D J Watmough *et al* 1970 *Phys. Med. Biol.* **15** 1-8 doi:10.1088/0031-9155/15/1/301

D J Watmough, Patricia W Fowler and R Oliver Department of Radiation Physics, Churchill Hospital, Headington, Oxford, UK **Abstract.** In clinical thermography the amount of heat energy received by the detector is interpreted in terms of a distribution of skin temperature but it also depends on the emissivity of the surface. It has been concluded previously that the emissivity in the range 2-5 μm for skin at normal incidence is about 0.98, and that variations are not likely to represent a difference in apparent temperature of more than ±0.5°C. However, theoretical considerations are presented for the variation of emissivity with the angle at which the surface is viewed. These indicate a significant fall in emissivity as the angle to the normal is increased beyond 90°, corresponding to a reduction of 4°C or more in apparent surface temperature. Thus it would be possible for a 'hot spot' associated with significant pathology to remain undetected on a surface viewed obliquely. Examples of this obliquity effect in clinical and experimental thermographs are demonstrated. Print publication: Issue 1 (January 1970) Received 30 April 1969

Current imaging modalities for the diagnosis of breast cancer. Edell SL, **Eisen MD**. Women's Imaging Center, Delaware Spect Imaging Center, USA. Although mammography still remains the gold standard for breast cancer screening and diagnosis, it typically cannot differentiate benign from malignant disease and is less accurate in patients with dense glandular breasts. This article is an overview of imaging modalities that have emerged to augment mammography and improve the accuracy of non-invasive breast cancer diagnosis. Ultrasound is currently used to differentiate breast masses and guide aspirations and biopsies. Magnetic resonance imaging has excellent sensitivity in demonstrating breast cancer but a low specificity. Nuclear medicine studies have recently emerged that detect the increased metabolic rate and vascularity of breast cancers. Other modalities, such as thermography and computed tomography, have a more limited utility for breast cancer diagnosis. Digital mammography is among other emerging technological advancements that will continue to develop and improve the accuracy of breast cancer diagnosis in the future.

212. The Present Status of Mammary Thermography

JoAnn D. Haberman M.D.1 1 Assistant Professor in Physical Medicine and Rehabilitation and Assistant Professor in Radiology, Temple University School of Medicine, Philadelphia, Pennsylvania. Thermography is a passive process completely safe and applicable to serial evaluations. The procedure is simple to perform, is painless, and requires no preparation. Instruments capable of producing thermograms in a fraction of a second are now available. As the very recent development of color thermography indicates, we can expect continued improvements in technology which will facilitate its medical applications. It is reasonable to assume that as more information is gained concerning thermobiology and the process of thermal pattern production the accuracy of thermogram evaluation will improve. Available data indicate a high degree of sensitivity for thermography. When combined with physical examination no cancers were missed. The total number of reported cases is still small from a statistical point of view and the percentages reported may change as larger studies become available for analysis. However, it is believed that the composite set of data contained in this report indicates the diagnostic potential of this modality. Encouraging was the detection of two lesions by thermography while they were still nonpalpable, and a sensitivity rate of 86.9 percent argues favorably for thermography's use as a screening tool.

Thermography

Thermography as a predictor of prognosis in cancer of the breast. Sterns EE, **Zee B**. Department of Surgery, Queens University, Kingston, Ontario, Canada. Although thermography is generally considered to lack sufficient sensitivity to be a useful in diagnosis of cancer of the breast, the association of a thermal abnormality with some breast cancers cannot be discounted. Breast cancers demonstrating such a thermographic abnormality have been reported to be associated with decreased survival when compared with patients with no such change. In a study of 214 patients confirmed to have breast cancer without distant metastases, 121 were found to have a thermographic abnormality. Patients whose tumors were thermographically abnormal had significantly larger primary lesions and a higher proportion of metastatic axillary lymph nodes. However, both the 5-year survival and the 5-year disease-free survival were not significantly different from patients who had no thermographic abnormality.

Thermography in breast cancer

213. H. J. Isard

JAMA, Vol. 268, Issue 21, 3074 December 2, 1992 **ARTICLES**

Thermography in breast cancer

H. J. Isard

Individual and combined effectiveness of palpation, thermography, and mammography in breast cancer screening. Gohagan JK, Rodes ND, Blackwell CW, Darby WP, Farrell C, Herder T, Pearson DK, Spitznagel EL, Wallace MD.

Cancer in the "cold" breast thermogram

HJ Isard The hallmark of the normal breast thermogram is relative symmetry of vascular configuration and thermal content with preservation of the breast contour. Accepted criteria of abnormality are predicated upon graphic and thermal asymmetry with emphasis placed upon elevated temperature, an increase in the number of discernible vessels, and distorted vascular patterns. The association of a confirmed breast cancer and an avascular thermogram has been labeled a false negative. Avascularity ("cold" breast), particularly in the lower half, with normal vessels in the same location of the opposite breast is suggested as an additional characteristic of abnormality. Illustrative cases are presented.

214. Effect of Forced Convection on the Skin Thermal Expression of Breast Cancer

Journal of Biomechanical Engineering -- April 2004 -- Volume 126, Issue 2, pp. 204-211

Lu Hu,1 Ashish Gupta,1 Jay P. Gore,1 and Lisa X. Xu1,2,3 1School of Mechanical Engineering 2Department of Biomedical Engineering, Purdue University, West Lafayette, IN 47907, USA 3School of Life Sciences and Technology, Shanghai Jiao Tong University, Shanghai 200030, P. R. China (Received May 10, 2003; revised December 4, 2003)

A bioheat-transfer-based numerical model was utilized to study the energy balance in healthy and malignant breasts subjected to forced convection in a wind tunnel. Steady-state temperature distributions on the skin surface of the breasts were obtained by numerically solving the conjugate heat transfer problem. Parametric studies on the influences of the airflow on the skin thermal expression of tumors were performed. It was found that the presence of tumor may not be clearly shown due to the irregularities of the skin temperature distribution induced by the airflow field. Nevertheless, image subtraction techniques could be employed to eliminate the effects of the flow field and thermal noise and significantly improve the thermal signature of the tumor on the skin surface. Inclusion of the possible skin vascular response to cold stress caused by the airflow further enhances the signal, especially for deeply embedded tumors that otherwise may not be detectable. ©2004 *ASME*

doi:10.1115/1.1688779

215. Prognostic Value of Thermographical Findings in Patients with Primary Breast Cancer

Breast Cancer Research and Treatment Springer Netherlands 0167-6806 (Print) 1573-7217 (Online)

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Medicine Tuesday, November 02, 2004

Dynamic Infrared Imaging of Newly Diagnosed Malignant Lymphoma Compared with Gallium-67 and Fluorine-18 Fluorodeoxyglucose (FDG) Positron Emission Tomography

Staging and therapy monitoring of malignant lymphomas relies heavily on imaging using arbitrary size criteria from computed tomography (CT) and sometimes non-specific radionuclide studies to assess the activity of the disease. Treatment decisions are based on early assessment of the response to therapy and the residual volume of the disease. Our initial experience is reported using a new noninvasive, inexpensive, and reproducible passive imaging modality, Dynamic Infrared Imaging (DIRI), which may add a new dimension to functional imaging. This system relies on its ability to filter the raw infrared signal using biological oscillatory behavior. It detects and analyzes minute oscillations of temperature and heat distribution in tumors. ***Introduction*** The treatment of malignant lymphomas depends heavily on imaging at the time of staging. With the progress in therapy there is an increasing demand for more frequent and accurate monitoring of the early response to treatment, as well as the detection of toxicity of chemotherapy. Early assessment of response and toxicity will allow more timely changes in the treatment of patients who are not responding, and may enhance the chances of decreasing toxic side effects and ultimately increase the prospect for a cure. Functional imaging techniques are becoming more widely accepted for this purpose, and imaging modalities using Ga-67 or FDG-PET show very promising results in this regard (1-5). Some studies suggest that very early restaging – as early as after one cycle of therapy – may be predictive of the treatment success or failure (1, 6). PET likewise, has been employed in the early monitoring of lymphoma patients on radio-immunotherapy (7). PET assessment of tumor glucose or amino acid metabolism with F-18 FDG, C-11 Thyrosin PET, C-11 cystein PET have shown very encouraging results in a variety of tumors, although larger studies are needed to confirm this concept (3, 7-9). Our report on this new imaging modality, Dynamic Infrared Imaging (DIRI) is based on our working hypothesis that tumors can be detectable as areas of long-wave (8-10◎m) infrared photon flux that exhibit significantly different temporal behavior when compared to non-diseased tissue. In this study, we compare the ability of Dynamic Infrared Imaging (DIRI) to depict tumor masses in lymphoma patients for staging and therapy monitoring against CT, Ga-67 and FDG–PET.

Breast

216. Breast Cancer: New Technologies for Risk Assessment and Diagnosis.

Special Article Molecular Diagnosis. 7(1):49-55, 2003. *Wright, Tracey; McGechan, Adam*

Abstract: In the US, one in every eight women will develop breast cancer in her lifetime. Despite the advances made in treating breast cancer, the causal mechanisms underlying this disease haveyet to be fully elucidated; 85% of breast cancer cases occur sporadically without any known genetic mutation. Too little is known about

the pathogenesis of breast cancer for primary prevention to be feasible in the near- to mid-term. Secondary prevention through screening offers an alternative that has been widely adopted. For decades, breast self-examination has been touted as a technique for the early identification of breast cancer. However, it has been recently suggested that this technique is a waste of time and resources for both doctors and patients. Mammography finds breast cancer earlier than breast self-examination, and will reduce the risk of death from breast cancer by approximately 30% in women over 50 years old. Mammography is limited in that cancer, like breast tissue, appears white on the x-ray; therefore lesions may be difficult to detect in women with very dense breasts, and a tumor may not cast a significant shadow until it is quite large. Some cancers are so aggressive that they can spread quickly, before routine screening can detect them. Despite these limitations, mammography is still viewed as the best tool currently available for screening and early diagnosis. Improved methods to detect and diagnose breast cancer early, when it is most curable, are required if a significant impact on morbidity and mortality from breast cancer is to be made. Various new and innovative technologies are being investigated for improving the early detection and diagnosis of breast cancer. About 85% of breast cancers begin in the milk ductal system of the breast. As cancer develops in the breast, abnormalities occur, including atypical hyperplasia, ductal carcinoma in situ, and invasive breast carcinoma. Thus, the early screening of ductal cells can provide a parallel benefit to the 'Pap' smear, which is used virtually universally to identify the abnormal cells that can lead to cervical cancer. Two technologies to monitor for atypical ductal epithelial cells are Cytyc Corporation's FirstCyte(TM) Ductal Lavage system and Nastech Pharmaceutical Company's Mammary Aspiration Cytology Test. Matritech, Inc. is searching for biomarkers linked to breast cancer. Researchers at Matritech have detected the presence of nuclear matrix protein (NMP) in the blood of women at the early stage of breast cancer, which is absent in the blood of healthy women, as well as those with fibroadenoma, a benign breast disease. NMP66 has been selected as a marker for further development and clinical trials of a test for use in the detection and monitoring of women with, or at risk for, breast cancer have been initiated. Technologies developed by the US Department of Defense are under investigation as breast cancer screening. Advanced Image Enhancement, Inc. has licensed naval sonar technology for digital image enhancement of mammograms. New thermography applications are also being investigated in two separate projects sponsored by the US Department of Defense using military thermal surveillance tools adapted for cancer detection. Both are enhancements of older thermal imaging technology based on the principle that heat equates to unwanted activity, in the case of breast cancer, abnormal cell proliferation.

217. An improved three-dimensional direct numerical modelling and thermal analysis of a female breast with tumour

Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine Professional Engineering Publishing 0954-4119

Volume 215, Number 1 / 2001 10.1243/0954411011533508 25-37

Authors

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Abstract

It is well known that malignant tumour tissue generally has higher metabolic and blood perfusion rates than most normal tissues. The authors aim to show that the tissue temperature profile within the breast and the surface temperature profile can be quantified to develop an expert system or diagnostic tool for breast cancer detection. The surface temperature and tissue temperature profiles are analysed for a three-dimensional numerical model of a normal breast and a breast with a tumour. Tumours of different sizes are placed at various locations. In the model, the tissue temperature profile is distorted at the tumour location and was found to compare well with *in vivo tests.* It was also found that as the tumour was moved to deeper locations its effect on surface temperature was lower. It was observed that small tumours in deeper regions do not have a significant isolated impact on the surface. The numerical results could also capture a shift in the position of the tumour. For tumours greater than 10mm in the superficial regions and of significant size in deeper regions, it could be seen that the surface temperature distribution of the breast is directly related to the position and size of the tumour embedded in it. The feasibility of providing a diagnostic tool in conjunction with numerical modelling and high-resolution thermograms is also discussed.

Thermographic diagnosis of breast disease] [Article in Japanese] **Usuki H**, **Takashima S**, **Saeki H**, **Moriwaki S**. Breast thermography was applied to 372 patients (49 with breast cancer and 323 with benign disease) between June 1984 and May 1985 at this Cancer Center. The thermographic findings obtained were quantitated and subjected to multivariate analysis to establish the diagnostic criteria for breast thermography. The result of diagnosis using the criteria revealed 87.8% as the sensitivity ratio and 67.8% as the specificity ratio. Even nonpalpable breast cancer could be diagnosed correctly. These facts and the noninvasive characteristics of this method indicate its validity as a screening test.

Parametric

Parametric optimization for tumour identification: bioheat equation using ANOVA and the Taguchi method

Authors

218. N M Sudharsan1, E Y K Ng1 1Nanyang Technological University School of Mechanical and Production Engineering Singapore

Abstract

Breast cancer is the number one killer disease among women. It is known that early detection of a tumour ensures better prognosis and higher survival rate. In this paper an intelligent, inexpensive and non-invasive diagnostic tool is developed for aiding breast cancer detection objectively. This tool is based on thermographic scanning of the breast surface in conjunction with numerical simulation of the breast using the bioheat equation. The medical applications of thermographic scanning make use of the skin temperature as an indication of an underlying pathological process. The thermal pattern over a breast tumour reflects the vascular reaction to the abnormality. Hence an abnormal temperature pattern may be an indicator of an underlying tumour. Seven important parameters are identified and analysis of variance (ANOVA) is performed using a 2n design (n = number of parameters, 7). The effect and importance of the various parameters are analysed. Based on the above 27 design, the Taguchi method is used to optimize the parameters in order to ensure the signal from the tumour maximized compared with the noise from the other factors. The model predicts that the ideal setting for capturing the signal from the tumour is when the patient is at basal metabolic activity with a correspondingly lower subcutaneous perfusion in a low temperature environment.

Evaluation of the ability of digital infrared imaging to detect vascular changes in experimental animal tumours

Wei Xie **1**, Pip McCahon **2**, Karen Jakobsen **1**, Christopher Parish **1 ***

ivision of Immunology and Genetics, John Curtin School of Medical Research, Australian National University, Canberra, Australia **2**Medical Infrared Digital Imaging Pty Ltd, Turner, Canberra, Australia

Thermography in screening for breast cancer

219. **KL Williams, BH Phillips, PA Jones, SA Beaman and PJ Fleming** Royal United Hospital, Bath, Avon, United Kingdom. STUDY OBJECTIVE--The aim of the study was to determine whether thermography could be used to identify women with breast cancer or women at risk of developing the disease within five

years. DESIGN-- Women were screened for breast cancer and a documentary follow up was conducted five years later through general practitioner records. SETTING--The project involved Women resident in the Bath District Health Authority area, who were invited to attend a breast screening clinic. SUBJECTS--10,238 women aged between 40 and 65 were screened. Of these, 4284 accepted personal letters of invitation from their general practitioners and 5954 volunteered to take part in the project in response to publicity; 9819 (96.5%) were traced after five years. MEASUREMENTS AND MAIN RESULTS--All the women had a thermographic and clinical examination of their breasts. If either examination was abnormal they were referred for mammography. Sensitivity of thermography was found to be 61% and specificity 74%. A documentary follow up of each woman was conducted five years later, when it was found that 71.6% of the women who developed breast cancer had had a normal thermogram at the time of examination, as did 73% of those who did not. CONCLUSIONS--Thermography is not sufficiently sensitive to be used as a screening test for breast cancer, nor is it useful as an indicator of risk of developing the disease within five years.

Prognosis and post-therapeutic follow-up of breast cancers by thermography. Gros C, **Gautherie M**, **Bourjat P**. Statistical analysis of approximately 800 cases of breast cancer followed up for at least 3-5 years with careful correlation between mammography, thermography and clinical data has confirmed the accuracy and indispensable use of thermography for prognosis and follow-up. Pre-therapeutic prognosis. Strong correlations exist between the thermographic class and survival for T1, T2 and T3 cancers, confirming the contribution of thermography in therapeutic decision. Thus, a T1 cancer should be treated differently depending on the thermographic findings. Post-irradiation follow-up. Correlations exist between the development of thermic anomalies and the effect of irradiation on the cancer, showing the possibility of confirming sterilization or early detection of a recurrence. This is valid only if the thermic effects of radiation on the skin and gland are recognized and discounted.

Surface

Surface Temperature Distribution of a Breast With and Without Tumour. Sudharsan NM, **Ng EY**, **Teh SL**. School of Mechanical and Production Engineering, Nanyang Avenue, Nanyang Technological University, Singapore 639798. Breast cancer is a common and dreadful disease in women. Regular screening helps in its early detection. At present the most common methods of screening are by self examination and mammography. The surface temperature distribution of the breast can also provide some information on the presence of tumour. This distribution has a relation to the size and location of tumour and can be seen using thermography, where the infrared radiation emitted from the surface of the breast is recorded and a thermal pattern obtained. Thermography is a non-invasive and an inexpensive tool which could be used for early detection. In order to simulate the surface temperature distribution, a two-dimensional model of female breast with and without a carcinoma is considered. The breast is modelled with varying layer thickness close to the actual shape and numerically solved using finite element analysis. Temperature profiles are obtained for a normal breast and for a malignant one by varying the tumour size, location and the blood flow rates. The results show that the surface temperature for a malignant breast is higher than that of a normal one. In addition the size and location of the tumour do have an effect on the surface temperature distribution. It can also be seen that tumour of different sizes placed at the same location would yield the same maximum temperature depending on the blood perfusion rate. PMID: 11264827 [PubMed - as supplied by publisher]

220. The evolving role of the dynamic thermal analysis in the early detection of breast cancer

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Abstract It is now recognised that the breast exhibits a circadian rhythm which reflects its physiology. There is increasing evidence that rhythms associated with malignant cells proliferation are largely non-circadian and that a circadian to ultradian shift may be a general correlation to neoplasia. Cancer development appears to generate its own thermal signatures and the complexity of these signatures may be a reflection of its degree of development. The limitations of mammography as a screening modality especially in young women with dense breasts necessitated the development of novel and more effective screening strategies with a high sensitivity and specificity. Dynamic thermal analysis of the breast is a safe, non invasive approach that seems to be sensitive for the early detection of breast cancer. This article focuses on dynamic thermal analysis as an evolving method in breast cancer detection in pre-menopausal women with dense breast tissue. Prospective multi-centre trials are required to validate this promising modality in screening. The issue of false positives require further investigation using molecular genetic markers of malignancy and novel techniques such as mammary ductoscopy.
Keywords: Circadian rhythm, breast cancer, screening and dynamic thermal analysis

Facial thermography during nasal provocation tests with histamine and allergen

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Abstract

Changes of skin temperature (T°) of the nose area during nasal provocation tests with histamine and allergen were followed by means of an infrared thermography camera. By a colimator system in which temperatures measured on a given surface can be integrated and averaged, thermography allows the continuous and quantitative recording of the temperature during the whole procedure in a completely noninvasive way. In 10 normal subjects, increasing doses of histamine induced a

dose-dependent rise of the nose external temperature. No significant change was observed with the vehicle solution. In six subjects allergic to grass pollen, the nebulization of increasing concentrations of a pollen extract induced a dose-dependent rise in T°. The T° rise observed after histamine or allergen corresponded to a marked nasal obstruction. The nebulization of the highest dose of the pollen extract did not induce any T° rise in six nonallergic subjects. The continuous recording of the skin temperature by a noninvasive method might yield additional information on the vascular changes rapidly occurring during nasal challenges.

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Screening for Fever by Remote-sensing Infrared Thermographic Camera

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Abstract

Background: Following the severe acute respiratory syndrome (SARS) outbreak, remote-sensing infrared thermography (IRT) has been advocated as a possible means of screening for fever in travelers at airports and border crossings, but its applicability has not been established. We therefore set out to evaluate (1) the feasibility of IRT imaging to identify subjects with fever, and (2) the optimal instrumental configuration and validity for such testing. ***Methods:*** Over a 20-day inclusive period, 176 subjects (49 hospital inpatients without SARS or suspected

SARS, 99 health clinic attendees and 28 healthy volunteers) were recruited. Remotely sensed IRT readings were obtained from various parts of the front and side of the face (at distances of 1.5 and 0.5m), and compared to concurrently determined body temperature measurements using conventional means (aural tympanic IRT and oral mercury thermometry). The resulting data were submitted to linear regression/correlation and sensitivity analyses. All recruits gave prior informed consent and our Faculty Institutional Review Board approved the protocol. ***Results:*** Optimal correlations were found between conventionally measured body temperatures and IRT readings from (1) the front of the face at 1.5m with the mouth open (r=0.80), (2) the ear at 0.5m (r=0.79), and (3) the side of the face at 1.5m (r=0.76). Average IRT readings from the forehead and elsewhere were 1°C to 2°C lower and correlated less well. Ear IRT readings at 0.5m yielded the narrowest confidence intervals and could be used to predict conventional body temperature readings of ≤38°C with a sensitivity and specificity of 83% and 88% respectively. ***Conclusions:*** IRT readings from the side of the face, especially from the ear at 0.5m, yielded the most reliable, precise and consistent estimates of conventionally determined body temperatures. Our results have important implications for walk-through IRT scanning/screening systems at airports and border crossings, particularly as the point prevalence of fever in such subjects would be very low.

222. Breast thermography is a noninvasive prognostic procedure that predicts tumor growth rate in breast cancer patients

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Our recent retrospective analysis of the clinical records of patients who had breast thermography demonstrated that an abnormal thermogram was associated with an increased risk of breast cancer and a poorer prognosis for the breast cancer patient. This study included 100 normal patients, 100 living cancer patients, and 126 deceased cancer patients. Abnormal thermograms included asymmetric focal hot spots, areolar and periareolar heat, diffuse global heat, vessel discrepancy, or thermographic edge sign. Incidence and prognosis were directly related to thermographic results: only 28% of the noncancer patients had an abnormal thermogram, compared to 65% of living cancer patients and 88% of deceased cancer patients. Further studies were undertaken to determine if thermography is an independent prognostic indicator. Comparison to the components of the TNM classification system showed that only clinical size was significantly larger ($p = 0.006$) in patients with abnormal thermograms. Age, menopausal status, and location of tumor (left or right breast) were not related to thermographic results. Progesterone and estrogen receptor status was determined by both the cytosol-DCC and immunocytochemical methods, and neither receptor status showed any clear relationship to the thermographic results. Prognostic indicators that are known to be related to tumor growth rate were then compared to thermographic results. The concentration of ferritin in the tumor was significantly higher (p = 0.021) in tumors from patients with abnormal thermograms (1512 +/- 2027, n = 50) compared to tumors from patients with normal thermograms (762 +/- 620, n = 21). Both the proportion of cells in DNA synthesis (S-phase) and proliferating (S-phase plus G2M-phase, proliferative index) were significantly higher in patients with abnormal thermograms. The expression of the proliferation-associated tumor antigen Ki-67 was also associated withan abnormal thermogram. The strong relationships of thermographic results with these three growth rate-related prognostic indicators suggest that breast cancer patients with abnormal thermograms have faster-growing tumors that are more likely to have metastasized and to recur with a shorter disease-free interval.

223. Computerized breast thermography: study of image segmentation and temperature cyclic variations

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Abstract

Breast cancer is a common and dreadful disease in women. The surface temperature and the vascularization pattern of the breast could indicate breast diseases. Establishing the surface isotherm pattern of the breast and the normal range of cyclic variations of temperature distribution can assist in identifying the abnormal infrared images of diseased breasts. This paper investigates the cyclic variation of temperature and vascularization of the normal breast thermograms under a controlled environment. More than 50 Asian women were examined and some of them have been examined continuously for two month. All together, not less than 800 thermograms were obtained. Before these thermograms can be analysed objectively via a computer algorithm, they must be digitized and segmented. The authors present a method to segment thermograms and extract the useful region from the background. After the image processing, these thermograms can be analysed and then the best time to perform an examination can be chosen. All these results are important for establishing a data bank of normal breast thermography, to choose the best time for an examination and as a systematic methodology for evaluating and analysing the abnormal breast thermography in the future.

Statistical analysis of healthy and malignant breast thermography

Authors: E. Y. K. Ng; L. N. Ung; F. C. Ng; L. S. J. Sim **DOI:** 10.1080/03091900110086642 **Publication Frequency:** 6 issues per year

Published in: Journal of Medical Engineering & Technology, Volume 25, Issue 6 November 2001 , pages 253 - 263 **Number of References:** 12 **Formats available:** PDF (English)

Sign In

Online Sample

Abstract Analysis of thermograms has often been subjective and has resulted in inconsistency in the diagnosis of breast diseases by thermography. The aim of this paper is to study the problem of subjective interpretation of breast thermograms and hence using thermography as an adjunct tool for breast cancer diagnosis. It was proposed that the thermograms should be taken within the recommended screening period, classified and analysed in conjunction with an artificial neural network (ANN). Qualitative interpretation of thermal images can be carried out using an active contours algorithm. The 256 ×200 pixel image can be segmented as one of the inputs to the ANN. To achieve quantitative analysis of the breast thermograms, firstly the inputs of the ANN should be determined, so that the thermograms could be successfully classified and based on the suggested inputs.

225. BREAST THERMOGRAPHY AFTER FOUR YEARS AND 10,000 STUDIES

HAROLD J. ISARD M.D., WARREN BECKER M.D., RUTH SHILO M.D., and BERNARD J. OSTRUM M.D. A total of approximately 10,000 breast thermograms was analyzed and further subdivided into symptomatic and asymptomatic groups of patients of 55 and 45 per cent, respectively. Positive, or abnormal, mammatherms were recorded in 36 per cent of thesymptomatic and 23 per cent of the asymptomatic groups. Of the 306 histologically confirmed cancers, 270 were in the symptomatic group of patients and 36 were clinically occult. Clinical accuracy was enhanced by the supplemental use of mammography and thermography. Sixty-one per cent of the occult cancers were suspect by thermography and if, in the asymptomatic group, thermography had been used as the initial screening procedure and mammography performed only on those with abnormal thermograms a yield of 21.4 cancers per 1,000 mammographic examinations would have been realized. Thermography is an innocuous examination that can be utilized for preliminary screening of asymptomatic women to focus attention upon those who should be examined more intensively because of greater risk of breast cancer.

BreastBreast thermography. A prognostic indicator for breast cancer survival. Isard HJ, **Sweitzer CJ**, **Edelstein GR**. Gershon-Cohen Breast Imaging Center, Department of Radiology, Albert Einstein Medical Center, Philadelphia, Pennsylvania 19141. A prognostic classification for thermographic staging of breast cancer has been applied to a cohort of 70 patients from 5040 screenees enrolled in the Albert Einstein Medical Center (AEMC) Breast Cancer Detection Demonstration Project (BCDDP). A diagnosis of breast cancer was established in each case before December 31, 1980. None of the patients have been lost to follow-up which extended from a minimum of 6 to a maximum of 13 years. Survival rates for those with favorable, equivocal, and poor thermographic factors are compared with each other and with results in accordance with tumor-node-metastasis (TNM) classification. As of December 31, 1986, there have been 22 (31.4%) deaths, all attributed to breast cancer. The thermographic scoring system clearly shows shorter survival for patients with poor thermographic prognostic factors, 30% surviving at 5 years and only 20% at 10 years compared with overall survival of 80% at 5 years and 70% at 10 years.

Analysis of breast thermography with an artificial neural network Koay, J. Herry, C. Frize, M. Dept. of Syst. & Comput. Eng., Carleton Univ., Ottawa, Ont., Canada;

226. This paper appears in: **Engineering in Medicine and Biology Society, 2004. IEMBS '04. 26th Annual International Conference of the IEEE** Publication Date: 1-5 Sept. 2004 Volume: 1, On page(s): 1159- 1162 Vol.2 ISBN: 0-7803-8439-3 INSPEC Accession Number: 8255112 Digital Object Identifier: 10.1109/IEMBS.2004.1403371 Posted online: 2005-03-14 08:31:38.0

Abstract Thermal imaging has been used for early breast cancer detection and risk prediction since the sixties. Examining thermograms for abnormal hyperthermia and hyper-vascularity patterns related to tumor growth is done by comparing images of contralateral breasts. Analysis can be tedious and challenging if the differences are subtle. The advanced computer technology available today can be utilized to automate the analysis and assist in decision-making. In our study, computer routines were used to perform ROI identification and image segmentation of infrared images recorded from 19 patients. Asymmetry analysis between contralateral breasts was carried out to generate statistics that could be used as input parameters to a backpropagation ANN. A simple 1-1-1 network was trained and employed to predict clinical outcomes based on the difference statistics of mean temperature and standard deviation. Results comparing the ANN output with actual clinical diagnosis are presented. Future work will focus on including more patients and more input parameters in the analysis. Performance of ANN network can be studied to select a set of parameters that would best predict the presence of breast cancer.

Computerized detection of breast cancer with artificial intelligence and thermograms

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Computed tomography in detection and diagnosis of breast cancer

229. C. H. Joseph Chang, MD **1** *, Justo L. Sibala, MD **1**, Steven L. Fritz, PhD **1**, Samuel J. Dwyer III, PhD **1**, Arch W. Templeton, MD **1**, Fritz Lin, MD **2**, William R. Jewell, MD **3**

Department of Diagnostic Radiology, University of Kansas Medical Center, Kansas City, Kansas

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From October 1, 1976 through July 31, 1979, at the University of Kansas Medical Center, CT/M examinations were performed on 1625 patients. Seventy-eight cancers were histologically diagnosed.

A CT/M study using our contrast medium enhancement technique yields both static anatomical changes and dynamic measurements of abnormal iodide concentrations in the breast cancers. This unique ability of CT/M provides many advantages as compared with conventional mammography in the diagnosis of breast cancer. The detection rate in 78 cancers by CT/M was 94% and 77% for the mammography.

The CT/M appears to be specially superior to the mammography for detecting cancers in dense, premenopausal dysplastic breasts. The CT/M can detect totally unsuspected very small breast cancers that were unable to be identified by conventional mammography or physical examinations. The CT/M scan also seems to be a better test for recognizing precancerous high risk lesions.

CT/M evaluation affords definitive diagnostic help in instances where the mammographic and/or physical examinations are inconclusive. Although CT/M will not replace conventional mammography in routine breast examinations, it overcomes the limitation of mammography.

230. **Thermobiological assessment of benign and malignant breast diseases.** **Gautherie M**. The recent technical and clinical advances in breast thermography are reviewed in this article. Emphasis is placed upon liquid crystal thermal imaging and computer-assisted analysis of breast thermograms. New data are presented concerning the value of thermography for the early detection of mammary carcinomas, the identification of women at high risk of developing breast cancer, and the detection of cancer in fibrocystic breasts.

PA van Dam, ML Van Goethem, E Kersschot, J Vervliet, IB Van den Veyver, A De Schepper and P Buytaert Department of Obstetrics and Gynecology, Antwerp University Hospital, Edegem, Belgium.

The diagnostic virtues and limitations of single- and multimodality testing in the evaluation of solid palpable **breast** masses were studied. Two hundred one consecutive patients who had a solid palpable **breast** mass and who underwent biopsy between September 1982 and July 1986 were included for blinded retrospective analysis of their physical examination, mammographic, ultrasonographic (US), thermographic, and pathologic characteristics. Benign **breast** disease was diagnosed histologically in 106 women, while carcinoma was established in 95. The sensitivities of physical examination, mammography, US, and **thermography** were 0.88, 0.94, 0.78, and 0.49, respectively. US alone had the highest sensitivity in correct diagnosis of a benign solid **breast** mass and had the highest accuracy (0.84). Use of four modalities increased the preoperative diagnostic true-positive rate to 0.97, with some decline in specificity. Multimodality testing seems particularly beneficial in pre- and perimenopausal patients. http://radiology.rsnajnls.org/cgi/content/abstract/166/2/435

Imaging of the radiographically dense breast

VP Jackson,

231. Imaging of the radiographically dense breast

VP Jackson, RE Hendrick, SA Feig and DB Kopans Department of Radiology, Indiana University Medical Center, Indianapolis. Despite recent improvements in mammography equipment and technique, the radiographically dense **breast** remains difficult to image. The problems in imaging the dense **breast** account for a large percentage of the cases of mammographically "missed" carcinomas. Other imaging modalities--such as ultrasonography, transillumination, **thermography**, computed tomography, magnetic resonance imaging, and radionuclide imaging--have been investigated for use in **breast** cancer detection. This overview discusses the current problems associated with imaging of the radiographically dense **breast** and suggests some avenues for investigation to develop solutions to these problems.

Diagnosis of breast carcinoma. An evaluation of clinical examination, mammography, thermography and aspiration biopsy in breast disease.

232. Bjurstam N, Hedberg K, Hultborn KA, Johansson NT, Johnsén C.

Microwave thermography: principles, methods and clinical applications. Myers PC, **Sadowsky NL**, **Barrett AH**. We review the physical principles, method of operation, measurement limitations, and potential medical applications of microwave thermography. We present detailed results of a study of breast cancer detection at 1.3 and 3.3 GHz, including the dependence of detection rates on microwave frequency, time, tumor depth, and tumor size. At 1.3 GHz, microwave thermography detects breast cancer as well as infrared thermography (true-positive rate = 0.76 when true-negative rate = 0.63). When the two methods are combined, the true-positive rate increases by about 0.1 over that of either method alone

233. Thermography of the female breast: a five-year study in relation to the detection and prognosis of cancer

CH Jones, WP Greening, JB Davey, JA McKinna and VJ Greeves

More than 12,000 women have been examined thermographically in the Breast Unit of the Royal Marsden Hospital, London. Of these women 1,464 had biopsy and histology; 363(25 per cent) were found to have carcinoma and of these 68 per cent had abnormal thermograms, 13 per cent has some thermal asymmetry of doubtful significance and 19 per cent had normal thermal patterns. Fifty-seven per cent and 62 per cent of patients with Stage I and Stage II cancer, respectively, had abnormal thermograms whereas 83 per cent of patients with Stage III cancer had abnormal thermograms. Of 1,101 women who had benign lesions, 63 per cent had normal thermal patterns, 15 per cent had thermal asymmetry of doubtful sabnormal thermograms. The subsequent histories of 172 cancer patients examined thermographically have been analysed and three-year survival rates have been correlated with thermography report, the clinical stage of the disease and the histotogical grade (Bloom, 1950) of the excised tumour. The mean three-year survival rates for patients with Stage II or Stage III cancer are 84 per cent for those with normal and 61 per cent for those with abnormal thermograms.

Emerging ignificance and 22 per cent had

234. **Nonmammographic breast imaging techniques. Heywang-Köbrunner SH**. Klinikum Grosshadern, University of Munich, FRG. Significant progress in early detection of malignancy has been achieved by the improvement of mammographic technique, the introduction of quality control, the demonstration of benefits from screening, and appropriate application of supplementary methods such as ultrasound, cytology, and stereotaxis. Certain problems in breast imaging, however, are still unsolved. These include early detection and exclusion of malignancy without microcalcifications in mammographically dense tissue (particularly in younger women), the still-limited accuracy of mammographic signs, and the management of diagnostic problems after surgery, radiation therapy, or silicone implants. Therefore, research is needed to further improve diagnostic capabilities. The research can be subdivided into different approaches: 1) further development of the mammographic technique (digital luminescence radiography); 2) evaluation of techniques that image other physical tissue properties (sonography, thermography, trans-illumination, CT, non-contrast-enhanced MR imaging, biomagnetism, biostereometry, and ductoscopy); 3) investigation of techniques that image metabolic changes (MR spectroscopy, positron-emission tomography) or metabolism-induced differences in perfusion or vascularity (Doppler ultrasound, contrast-enhanced MR imaging); and 4) development of techniques that attempt tissue diagnosis using monoclonal antibodies. Among these techniques, digital luminescence radiography and contrast-enhanced MR imaging are the most developed and the most promising. They are at the threshold of becoming clinically important. Doppler ultrasound could be useful for certain indications. Whereas MR spectroscopy, positron-emission tomography, the search for appropriate antibodies, and possibly transillumination, ductoscopy, and biomagnetism offer interesting new aspects for research, the value of CT, thermography, and biostereometry is not yet established.

235. Utility of thermography in the diagnosis of lumbosacral radiculopathy

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Department of Neurology (Drs. Harper, Low, and Fealey, C.J. Proper, and D.A. Gillen), Mayo Clinic and Mayo Foundation, Rochester, MN, and Department of Neurology (Dr. Chelimsky), Case Western Reserve University, Cleveland, OH.

We performed infrared telethermography in 55 patients with the clinical diagnosis of lumbosacral radiculopathy and in 37 normal controls. Five readers interpreted the thermograms in a blinded fashion. A moderate degree of agreement was noted in tests of intraobserver and interobserver variability. The sensitivity of thermography

ranged from 78% to 94% compared with 81% to 92% for imaging studies and 77% for EMG. The specificity of thermography ranged from 20% to 44%. Thermography predicted the level of the radiculopathy correctly in less than 50% of cases. Thermography has little or no utility in the diagnosis of lumbosacral radiculopathy.

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236. **Breast Thermal Imaging, The Paradigm Shift**

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CCC-LA

Summary

Infrared thermal imaging of the breast, a non-invasive adjunctive diagnostic methodology has become all but non-existent in the United States. This is in large part due to extensive debate concerning thermography in the trial courts, related to spinal injury cases and also due to the model or basis used for breast thermal imaging. This paper attempts to identify possible factors which will bring thermal breast imaging back into serious mainstream consideration as a valid adjunct to overall breast pathology diagnosis.

Szacsky Mihály