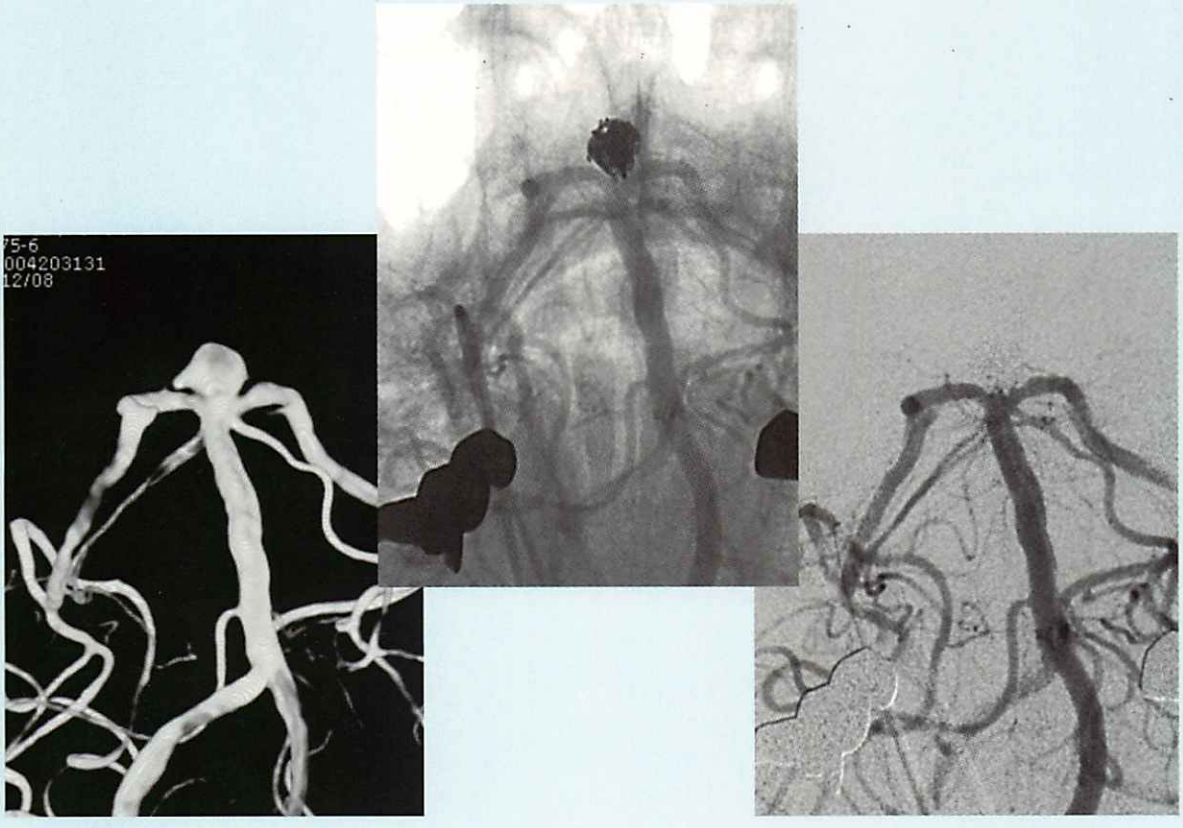
第3回
日本脳神経血管内治療学会
関東地方会



会期 2006年6月24日(土)

会場 聖路加看護大学講堂
(ALICE C.ST.JOHN Memorial Hall)

会長 小林繁樹（千葉県救急医療センター）

ご 挨 拶

脳神経領域における血管内治療の進歩はめざましく、特に脳血管障害の分野では重要な位置を占める治療法になっております。1983 年に発足した日本脳神経血管内治療学会の会員数は毎年増加の一途をたどり、全国に 1950 余名を数えるほどの学会に発展しました。このように専門性が高い上に成長著しい分野であるがために、治療にたずさわる医師には正しい知識を吸収し、また安全で効果的な治療技術を習得することが要求されます。このような背景より、全国規模の学術総会とは別に各地区での医療環境に応じた学術活動が必要となり、関東地区では平成 16 年に地方会が立ち上がりました。本会の目的は前述のごとく、会員に必要な血管内治療に関する最新の情報を提供するとともに、血管内治療技術の向上を促進し、関東地区での血管内治療の普及と発展に貢献することにあります。第一回関東地方会では園部 眞会長により硬膜動静脈瘻が、そして第 2 回関東地方会では根本 繁会長によって頸動脈ステントが主題として取り上げられ、活発な討議が行われました。第 3 回にあたる今回は、脳動脈瘤塞栓術を主題といたしました。種々の血管内治療のなかでも、脳動脈瘤塞栓術は我々が最も施行することの多い手技ですが、それゆえに自己流であったり、意外な盲点や落とし穴に気付いていない可能性もあろうかと思います。今回のプログラムは、一般講演・教育講演・ビデオセッションの 3 部構成とし、この分野で活躍されている先生方に、脳動脈瘤の成因や病態から現在行われているテクニック、さらには近未来のデバイスや治療法に至るまで、脳動脈瘤治療に関するすべてを伝授していただこうと考えております。この学術集会が会員各位にとって有意義なものとなり、同時に本手技がより安全で有効な治療法となる一助となれば幸いです。

最後に、本学術集会の開催に当たり御協力をいただいた関係業界各社に心から御礼申し上げます。

平成 18 年 6 月

第 3 回日本脳神経血管内治療学会関東地方会

会 長 **小 林 繁 樹**

ご 案 内

1．会　　期　　平成 18 年 6 月 24 日(土)　9 時 55 分～16 時 30 分

2．会　　場　　聖路加看護大学　ALICE C.ST.JOHN Memorial Hall

3．参加受付　　参会受付にて参会費 3000 円をお支払いください。
また、連絡先・所属等に変更がある場合には、受付にてその旨お申し出ください。

4．演題発表　　一般演題は発表 5 分、討論 2 分です。プログラムが詰まっておりますので、時間厳守でおねがいいたします。
発表は PC 本体の持ち込みを原則とします。Power Point のファイルを USB メモリーあるいは CD-R に記録したものも受け付けます。

5．運営委員会　　昼食時間中に病院別棟 1 号館 5F 研修室 B にて運営委員会を行います。運営委員の方はお集まりください。

6．昼　　食　　昼食は先着 100 名分は弁当（別途有料）を用意します。
受付にてお申し込みの上、病院別棟 1 号館 5F 研修室 A にてお召し上がりください。

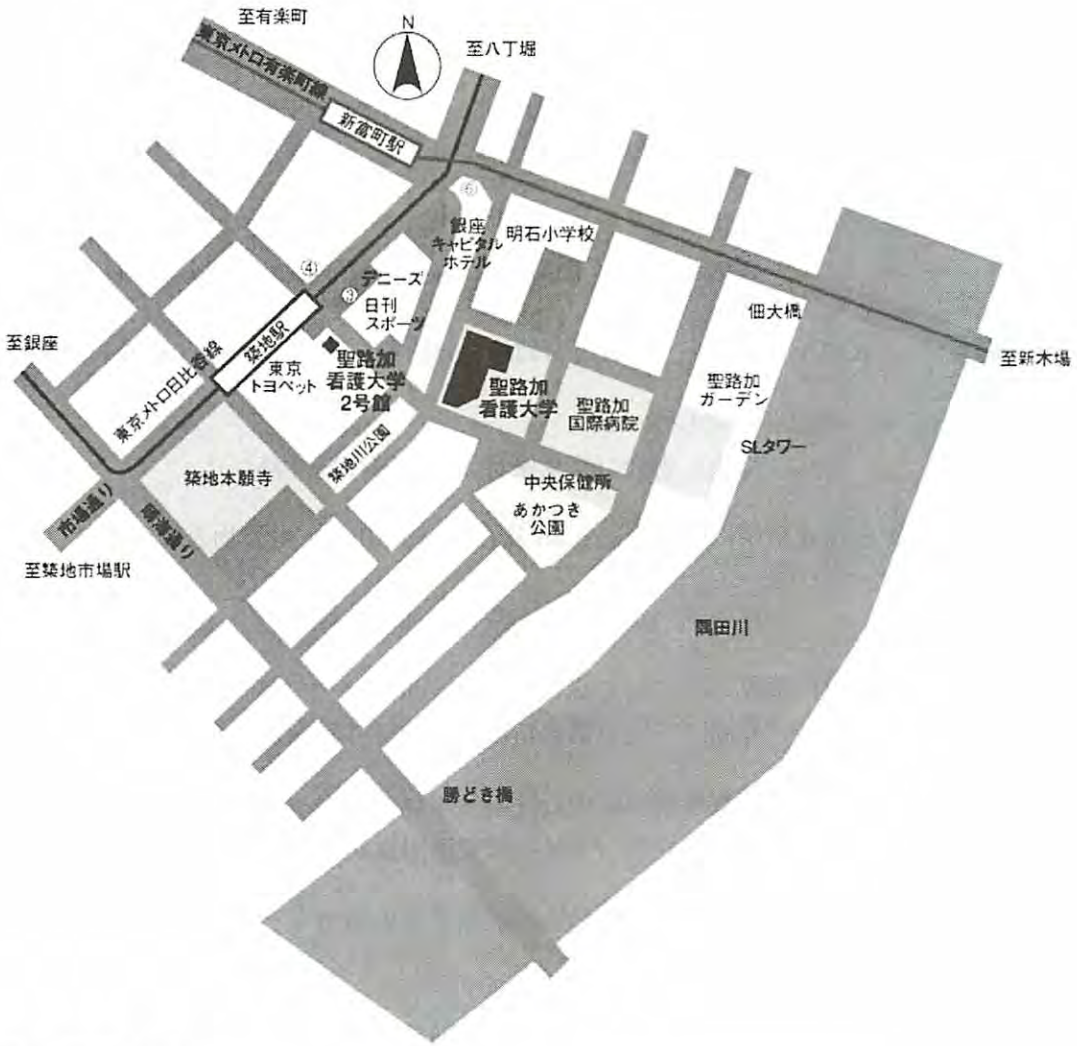
7．そ の 他　　講堂内は飲食禁止です。また、敷地内は禁煙ですのでご注意ください

聖路加看護大学へのアクセス

東京メトロ 日比谷線 築地駅 3番出口を出て、正面のデニーズと東京トヨペットの間の角を左折し、直進(徒歩 3 分)

東京メトロ 有楽町線 新富町駅 6番出口を出て、新大橋通り沿いに直進。デニーズと東京トヨペットの間の角を左折し、直進(徒歩 5 分)

都営地下鉄大江戸線築地市場駅下車 徒歩 15 分



聖路加看護大学

〒104-0044 東京都中央区明石町 10-1 tel: 03-3543-6391

プログラム

1．開会の辞　　9:55

2．一般演題 I　　10:00-10:45　（発表 5 分討論 2 分）　　座長：岩渕　聡

未破裂脳動静脈奇形の経過観察中に発生した de novo 脳動脈瘤破裂の 1 例
片山　正輝（東京歯科大学市川総合病院　脳神経外科）

解離性椎骨動脈瘤 Trapping の 2 年後に出現した解離性脳底動脈瘤の 1 例
佐藤　洋平（東京医科歯科大学　脳神経外科）

巨大部分血栓化脳底動脈先端部動脈瘤に対する両側椎骨動脈塞栓術の可否
大野　晋吾（東京医科大学八王子医療センター　脳神経外科）

後大脳動脈末梢部(P2 segment)の未破裂大型動脈瘤の 1 例
重田　恵吾（武蔵野赤十字病院　脳神経外科）

脳動脈瘤塞栓術における laminar flow aneurysmography の有用性について
田中美千裕（亀田総合病院　脳神経外科）

浅側頭動静脈瘻の一例
大橋　智生（東京医科大学霞ヶ浦病院　脳神経外科）

3．一般演題 II　　10:45-11:40　（発表 5 分討論 2 分）　　座長：大石　英則

Detach 後に coil の変形を来した一例
稲次　忠介（東京医科大学　脳神経外科）

未破裂脳動脈瘤塞栓術中に coil migration 及び microcatheter 内異物と 2 度トラブルを来たした 1 例
島田　　篤（白河病院　脳神経外科）

脳動脈瘤塞栓術中の逸脱 coil に対する loop trap technique
今岡　　充（横浜新都市脳神経外科病院　脳神経外科）

破裂前交通動脈瘤コイル塞栓術後に中心性脳ヘルニアとなった 1 例
清水　立矢（老年病研究所附属病院　脳神経外科）

コイル塞栓術後に開頭手術を追加した脳動脈瘤症例の検討
キッティポン スィーワッタナクン（旭中央病院　脳神経外科）

血管内治療を施行したが増大し続けた椎骨動脈紡錘状動脈瘤の 1 例
久保　　毅（虎の門病院 脳神経血管内治療科）

クリッピング後に再発した動脈瘤に対するコイル塞栓術
保谷　克巳（獨協医科大学越谷病院　脳神経外科）

4．一般演題III　11:40-12:30　（発表 5 分討論 2 分）　座長：植田　敏浩

睡眠時無呼吸症候群を伴う椎骨動脈瘤の一例
嶋口　英俊（群馬大学大学院　脳脊髄病態外科学）

後方向き前交通動脈瘤に対する瘤内塞栓術の問題点
須磨　　健（相模原協同病院　脳神経外科）

中大脳動脈瘤の塞栓例
林　　高樹（越谷市立病院　放射線科）

脳動脈瘤治療 in Paris
森嶋　啓之（聖マリアンナ医科大学　脳神経外科）

ステントを併用し治療した破裂解離性椎骨動脈瘤の 1 例
岩本　和久（北里大学医学部　脳神経外科）

脳動脈瘤塞栓術における HyperForm Balloon Catheter の使用経験
大石　英則（順天堂大学医学部　脳神経外科）

5．昼　　食　12:30-13:30　（運営委員会を研修室 B で行います。）

6．議事総会　13:30-13:45

7．教育講演　13:45-14:50

① 脳動脈瘤に関する文献レビュー（15 分）　座長：小西　善史
中居　康展（水戸医療センター　脳神経外科）

② 脳動脈瘤の可視化実験（20 分）　座長：倉田　　彰
氏家　　弘（東京女子医大　脳神経外科）

③ 近未来の脳動脈瘤塞栓術（20 分）　座長：沼口　雄治
村山　雄一（東京慈恵会医科大学　脳神経外科脳血管内治療部）

8．ビデオセッション　15:00-16:15　座長：小林　繁樹

① balloon neck remodeling technique I （20 分）
松丸　祐司（虎ノ門病院　脳神経血管内治療科）

② balloon neck remodeling technique II （20 分）
石原正一郎（埼玉医科大学　脳神経外科）

③ double catheters technique （20 分）
村尾　健一（国立循環器病センター　脳神経外科）

④ 特殊なテクニック（15 分）
戸根　　修（武蔵野赤十字病院　脳神経外科）

コメンテータ

飯塚　有応、岩渕　聡、大石　英則、渋谷　肇、園部　眞、

玉谷　真一、内藤　功、根本　繁、宮城　修、森　貴久

9．閉会の辞　　16:15-16:20

一　般　演　題　抄　録

未破裂脳動静脈奇形の経過観察中に発生した de novo 脳動脈瘤破裂の 1 例

[1]東京歯科大学市川総合病院
脳神経外科
[2]足利赤十字病院
脳神経外科

片山　正輝[1,2]
中川　　享[2]
村上　秀樹[2]

未破裂脳動静脈奇形の経過観察中に発生した de novo 脳動脈瘤破裂の 1 例を経験したので報告する。症例は 48 歳の男性で、突然の左不全麻痺と意識障害にて、搬送された。6 年前に前交通動脈瘤破裂によるくも膜下出血を発症したため、クリッピング術、水頭症に対して LP シャント術後であった。その際に、右頭頂葉の右中大脳動脈を主流入動脈とする脳動静脈奇形を認めたが、本人の希望で経過観察されていた。来院時、JCSI-2、GCS E4V4M6、左不全麻痺を認めた。頭部 CT 上、くも膜下出血と右側頭葉皮質下出血を認め、脳血管撮影上、右中大脳動脈瘤破裂によると診断して、コイル塞栓術を施行した。以前の脳血管撮影上は、右中大脳動脈瘤を認めず、6 年の経過中に発生したと考えられた。脳動静脈奇形に合併した脳動脈瘤新生に関して、文献上の考察を加えて報告する。

MEMO

解離性椎骨動脈瘤 Trapping の 2 年後に出現した解離性脳底動脈瘤の 1 例

東京医科歯科大学
[1]脳神経外科
[2]救急部
[3]武蔵野赤十字病院
脳神経外科

佐藤　洋平[1]
前原　健寿[1]
青柳　　傑[1]
大野喜久郎[1]
磯谷　栄二[2]
戸根　　修[3]

症例は初発時 67 歳の女性。抗リン脂質抗体症候群で通院中、左顔面神経麻痺および構語障害で発症し、脳梗塞疑いで当院神経内科に入院した。入院 6 日目に激しい頭痛、嘔吐が出現し、腰椎穿刺でクモ膜下出血と診断され、当科入院となった。入院時右上下肢 4/5 の麻痺、および Grade2 の左顔面神経麻痺を認めた。AG で左椎骨動脈解離性動脈瘤と診断し、Trapping 術が施行された。術後リハビリテーションを行い、軽度の嗄声、右不全片麻痺を残し自宅退院となった。およそ 2 年 3 ヶ月後再び頭痛、嘔吐が出現。CT でクモ膜下出血を認め当科入院となった。AG では前回 Trapping した遠位から脳底動脈にかけて 3 カ所の dome を伴う解離性動脈瘤を認めた。脳血管内治療をおこなったが難渋し、一番大きな dome のみ塞栓し、終了した。術後リハビリテーションを行い自宅退院。現在右下肢に軽度麻痺があるものの自宅での ADL は自立し、歩行可能である。
今後の治療方針をふまえて、今回の治療経過について検討したい。

MEMO

巨大部分血栓化脳底動脈先端部動脈瘤に対する両側椎骨動脈塞栓術の可否

[1]東京医科大学八王子医療センター 脳神経外科
[2]東京医科大学 脳神経外科

大野　晋吾[1]
村上　　守[1]
橋本　孝朗[2]
鬼塚　俊朗[2]
池田　幸穂[1]
原岡　　襄[2]

【はじめに】巨大部分血栓化脳底動脈先端部動脈瘤は外科治療および血管内治療のどちらに於いても非常に治療困難である。今回我々は、両側の椎骨動脈を閉塞し、動脈瘤に対する血行力学的ストレスを減じ、症状の進行および動脈瘤増大制御し得ている症例を経験していた。文献的考察を加え報告する。
【症例】50 歳女性、右側完全動眼神経麻痺を呈し来院、血管撮影にて脳底動脈先端部に約 2cm の部分血栓化動脈瘤を認めた。血栓は動脈瘤のネック近傍にもみられた。その後瘤の増大とともに、顔面上肢の知覚異常、右運動失調、右片麻痺と症状進行あり、両側椎骨動脈閉塞試験を行い、優位側（右）より 2 期的に両側椎骨動脈閉塞を行った。初回閉塞時頚髄梗塞を合併した。術後完全消失は無いものの、徐々に動脈瘤の血栓化および縮小傾向が見られ、それに伴い動眼神経麻痺の改善されてきた。
【考察】種々の報告でクッリッピング困難な症例に対する、親動脈閉塞は比較的安全でその有効性もあると報告されている。本治療の最大の問題点としては、特に本例ような塞栓、血栓による虚血性合併症が重要である。その原因としてはヘモダイナミックなものより血栓塞栓、穿通枝閉塞が多いと報告され、可能であれば術前よりの抗血小板療法、術中の抗凝固療法を十分に行う必要がある。部分血栓化大型動脈瘤では種々の治療を考慮し、個々の例の状況に合わせ治療することが重要と考える。

MEMO

後大脳動脈末梢部(P2 segment)の未破裂大型動脈瘤の1例

武蔵野赤十字病院
脳神経外科

重田　恵吾
戸根　　修
富田　博樹
宍戸　恒郎
秋元　秀昭
横堀　將司
山本　崇裕
長崎　弘和

30歳代男性。左視床梗塞の精査で左後大脳動脈(PCA)末梢部(P2 segment)に直径10mmを超える大型動脈瘤が偶発的に発見された。動脈瘤は PCA の posterior temporal artery(PTA)分枝部から拡張し、動脈瘤の末梢から calcarine artery (CA)と parieto-occipital artery (POA)が分枝していた。塞栓術に先立ち balloon test occlusion (BTO)を行った。全身ヘパリン化のもと、動脈瘤の近位部で P2 segment を balloon で約20分閉塞し、視野障害や言語障害の有無を確認した。僅かに右視野の見にくさを訴えたが、他に明らかな神経症状の出現は認められなかった。BTO を行いながら左頚動脈撮影を行うと PTA、CA、POA は中大脳動脈と、前大脳動脈からの側副血行路から、わずかに遅れて造影された。以上の所見から、側副血行が十分と判断し、後日、瘤内塞栓と動脈瘤近位部の親動脈塞栓術を施行した。術後新たな脳梗塞は合併せず、視野欠損も生じなかった。P2 segment の動脈瘤に対して、親動脈を閉塞することにより、PCA 末梢の脳梗塞を合併しないかどうかを確実に予見することは困難と考えられるが、側副血行が認められる場合は安全との報告がある。本症例のように未破裂動脈瘤の場合は、BTO により側副血行を確認する方法は、有用な方法と考えられる。

MEMO

脳動脈瘤塞栓術における laminar flow aneurysmography の有用性について

亀田総合病院
脳神経外科

田中美千裕
印東　雅大
坂田　義則
久保田基夫

【Objective】瘤内の流体力学は塞栓術において重要である。今回 aneurysmography を行い、瘤の flow dynamics を解析。また瘤の再開通率について比較し、その有用性について評価した。

【Methods】対象は未破裂動脈瘤 20 例。瘤のネック近傍からマイクロカテーテルより 0.5ml/sec の造影で aneurysmography を施行。秒間 4 フレームの DSA で拡大した画像を解析し、inflow zone や outflow zone を描出し、3D-rotation angiography より予想される flow dynamics と比較。また inflow zone の完全閉塞群と、不完全閉塞群に分けて再開通率を評価した。

【Results】全例で aneurysmography により inflow zone, out flow zone を描出できた。平均 1 年 4 ヶ月の術後経過中、inflow zone の完全閉塞群 15 例(内 4 例は outflow zone が不完全閉塞)では再開通を認めなかった。inflow zone の不完全閉塞群 5 例中、1 例で術 1 年後の MRA で瘤の再開通を認めた。

【Conclusions】laminar flow aneurysmography は瘤内 flow dynamics 描出に有用であった。inflow zone の packing density を高めることにより、長期成績の向上が期待された。

MEMO

浅側頭動静脈瘻の一例

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【はじめに】経動脈的塞栓術（以下 TAE）でシャントの完全消失を得た外頸動静脈瘻（以下 AVF）を経験したので、若干の文献的考察を加え報告する。
【症例】55 才女性。約 30 年前より左頸部の腫瘤に気付き、当時脳血管撮影を受けたが、その後は放置。平成 18 年 1 月になり、当院耳鼻科を経由し脳神経外科に紹介受診した。来院時、左頸部に柔らかい拍動性の腫瘤および血管性雑音を認める他、脈拍が 100ー120/min であった。頭頸部 MRI・MRA、その後脳血管撮影および BOT を行い、左浅側頭動脈の AVF と診断した。AVF は極めて high flow であり、外頸動脈特有のネットワークにより多彩な経路での描出が見られたが、shunting point と思われる部分は比較的限局していると判断し、3 月 31 日 TAE を行った。塞栓は離脱式コイルを用い、外頸動脈各枝および浅側頭動脈の遠位側より行った。当日はシャント量の著明な減少が得られた時点で終了とした。終了直後より左頸部腫瘤は著明に縮小しており、同日より腫瘤部の圧迫固定を開始した。その後血管性雑音は徐々に消失、一週間後の血管撮影ではシャントの完全消失が得られた。
【結果】外頸 AVF は比較的稀な疾患であるが、外頸動脈特有の多彩なネットワークにより、治療には大変難渋する事が多い。今回は事前の BOT により、シャント部位を綿密に調べた結果、頸動脈的塞栓術で完全消失が得られた。

MEMO

Detach 後に coil の変形を来した一例

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【はじめに】wide neck の動脈瘤に対する塞栓術においては、neck 近傍の coil が血流により動いてしまうことが散見される。今回、我々は small size の VA-PICA 動脈瘤の塞栓術中、coil detach 後に coil の loop が PICA に引きずり出された case を経験したので考察する。

【症例】38 歳、女性。H&K grade II、WFNS grade II、Fisher group 4 のクモ膜下出血で入院となった。脳血管撮影上、lt VA-PICA に大きさ 3.5×2.5×2.5mm、neck2.5mm の破裂脳動脈瘤を認め、そのまま瘤内塞栓術を行った。動脈瘤は PICA の肩に乗るように存在し、GDC 10 US 3×6、2.5×4 を挿入した。detach 直後は、動脈瘤内に収まっていたが、徐々に 2 本目の coil の loop が proximal neck より PICA 側に引きずり出される様に変形を認め、PICA が閉塞してしまった。破裂脳動脈瘤であり、ウロキナーゼでの血栓溶解は再破裂の危険性が高いと考え、guiding catheter および micro catheter よりヘパリン加生理食塩水を多量に還流した。さらに、アルガトロバンの DIV、アスピリンの内服を併用したところ、再開通を認め、動脈瘤は完全閉塞の状態であった。

【結論】coil の loop が親動脈に引きずり出される原因としては、coil の loop が proximal neck から distal neck までを跨いでいないこと、coil の loop に血流が垂直にあたることが考えられる。このような事の予防には、neck 近傍の loop の作り方にも十分に注意が必要と考えられる。

MEMO

未破裂脳動脈瘤塞栓術中に coil migration 及び microcatheter 内異物と 2 度トラブルを来たした 1 例

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【目的】未破裂 Lt IC(C2) An に対しての塞栓術中に coil migration と microcatheter 内異物混入を認め、2 度のトラブルに遭遇した症例を経験したので報告する。
【症例】59 歳、女性。後頸部痛主訴に来院。後頸部痛以外、神経学的異常所見認めず。MRI/MRA にて Lt IC(C2 portion) An 指摘。治療希望あり血管内手術を選択。
【塞栓術】1 回目の塞栓術では、1st coil が detach 前に delivery wire から外れ、balloon の隙間を抜けて distal migration。Retriever、Attracter での回収操作中に M2-3 まで migration。最終的に Goose neck snare 2mm にて回収し、塞栓術は中止。2 回目 coil 塞栓術では、2nd coil が抵抗あり回収。Cathe 内に半透明線維状 3mm ほどの物質あり回収し。塞栓術はそのまま続行し完全閉塞を得た。
【結果・考察】①Coil migration の原因・問題点；Unraveling は無く、detach point で coil は切れており、coil が delivery wire から外れた原因は分からず。Distal migration は、最初に cathe を引いたことが 1 つの誘引となり、回収がうまく行かず、さらに distal migration を来たした。最初から Goose neck snare を通し、回収すべきであった。また distal migration を予防するために assist balloon を十分 inflation すべきであった。②Microcatheter 内異物；ポリプロピレンとほぼ同一の材質で、catheter lumen 内材質とは異なり、どこから混入したかは不明であった。
【結語】Balloon assisted coil 塞栓術中に coil migration を来し、回収に難渋し、2 度目の塞栓術中に microcatheter 内に異物混入を認めた症例を経験した。

MEMO

脳動脈瘤塞栓術中の逸脱 coil に対する loop trap technique

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尾崎　聡
古市　晋
谷井　雅人
吉澤　卓
山際　修
伊藤建次郎

【緒言】脳動脈瘤塞栓術の操作中、既に離断留置後の coil の一部が親動脈側に逸脱してしまう事態が時にみられる。放置して問題ないこともあるが、遠位塞栓や分枝閉塞等の虚血性合併症の原因になり得るため、可能な限り解決しておきたい。coil を回収する解決方法も考えられるが、逸脱 coil の回収は必ずしも安全でなく、むしろ逸脱 coil を瘤内へ還納することが望ましい。我々はこのような場合に loop traptechnique の積極的な適用が極めて有効であると考えている。

【症例 1】48 歳女性、未破裂 IC-SHA 動脈瘤。3D-GDC で flaming 後、remodeling technique を併用しながら 2ndcoil を挿入していたが、flame coil の変形により 3D-GDC の small loop が親動脈に逸脱した。coil 回収は試みず、挿入中の 2nd coil を使って loop trap technique により逸脱 coil を捕捉し、瘤内へ還納した。以後も塞栓を続行し、問題なく手技を終了した。

【症例 2】52 歳女性、未破裂 VA-PICA 動脈瘤。3D-GDC で flaming 後、2nd coil を挿入中に flame coil が変形して PICA 側へ逸脱した。loop trap technique によって、変形・逸脱した flame coil を修正し、問題なく手技を終了した。

【考察・結語】脳血管内治療を施すにあたり、あらゆるトラブルを想定し対策を立てた上で臨まねばならない。術中の coil 逸脱に対する loop trap technique はトラブル回避に極めて有用であり、必ず習得すべき技術であると考えられる。

MEMO

破裂前交通動脈瘤コイル塞栓術後に中心性脳ヘルニアとなった１例

老年病研究所附属病院
脳神経外科

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高玉　　真
岩井　丈幸
内藤　　功

【はじめに】破裂脳動脈瘤に対するコイル塞栓術は、脳圧亢進に対する対処が困難で時に致命的となる。今回我々は、破裂前交通動脈瘤コイル塞栓術後に中心性脳ヘルニアへ急速に進行した１例を経験したので報告する。

【症例】38 歳男性。意識障害で発症。来院時 JCS II-20、麻痺なし。CT で右前頭葉の ICH、脳室穿破を伴う SAH を認めた。血管撮影で前交通動脈瘤を認め、全身麻酔下にコイル塞栓術を施行した。

【手術】neck を挟んで上下に膨らんだ瘤であり、double catheter technique を用いた。Prowler14 を動脈瘤上方成分に留置、Excelsior SL-10 を neck 近傍に留置した。SL-10 から、GDC-2D 6x20 を挿入し frame を作成し、GDC-US 4x8: 2 本、4x6: 2 本、3x6: 1 本を挿入し完全閉塞を得た。この間、左 A2 の orifice 近くに血栓形成を認めたため、SL-10 をこの直前に留置してウロキナーゼ６万単位を動注し、血栓は縮小した。

【術後経過】術５時間後、意識は JCS II-10 まで改善したが、その後数時間で意識障害が悪化（III-100）、水頭症の進行を認めたため、脳室ドレナージを施行した。しかし、脳圧亢進が著明で、術後 CT で第Ⅲ脳室の下垂を認め中心性脳ヘルニアと考えられた。脳圧管理目的にバルビツレート療法を行うも改善無く死亡した。

【考察】以下の点について検討する。①血管内治療の選択は適切であったか、②コイル塞栓術中の問題点、③術後管理上の問題点、④中心性脳ヘルニアの臨床所見、CT 所見について。

MEMO

コイル塞栓術後に開頭手術を追加した脳動脈瘤症例の検討

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持田　英俊
大屋　　滋
渡辺　三郎
冨田　　伸

【はじめに】平成 16 年 4 月より平成 18 年 3 月までの間当院での脳動脈瘤塞栓術は 73 例であった。(同時期のクリッピング術 80 例) そのうち 4 例に塞栓後に開頭手術を追加した。これらの症例の問題点、手術適応などについて検討した。

【代表症例】症例 1：67 歳女性　動眼神経麻痺にて発症。右 ICPC の動脈瘤の塞栓術を行った。大きなブレブを伴っていたが、塞栓は動脈瘤のネックにのみ行った。術後一週間で再開通が見られ、開頭手術を行った。考察：動脈瘤の流入部のみを閉塞させることができたが、再開通が見られた。初回より開頭手術を行うべきとも思われたが、コイル塞栓術を行うことにより、術中の操作が容易となるという利点も考えられた。

症例 2：52 歳男性　くも膜下出血発症 WFNS grade 5 day1 にて wide neck な Acom 動脈瘤に対し、コイル塞栓術を行った。意図的な部分塞栓術で後日回復を待ち、day32 に開頭クリッピング術を行った。軽度室見当識のみ残存した。考察：動脈瘤の形状はコイル塞栓には不向きであったが、一時的なコイルの止血効果を期待し、脳の回復を待ち、より安全に開頭術を行うことができた。

【結語】コイル塞栓術後に開頭手術を行う必要がある症例を経験した。治療戦略としては開頭手術を最初から行うべきとも考えられたが、コイル塞栓を行うことによりその後の開頭手術をより安全で侵襲の少ないものにできたと思われる。

MEMO

血管内治療を施行したが増大し続けた椎骨動脈紡錘状動脈瘤の1例

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【はじめに】紡錘状動脈瘤(FA)は、コイルによる閉塞が原則であるが、部分血栓化し、mass effect を呈するまで巨大化した場合には治療が難しい。今回我々は mass effect で発症した頭蓋内椎骨動脈(VA)の部分血栓化巨大 FA に対し、血管内治療を施行したが増大し続けた症例を経験したので報告する。
【症例】患者は 42 歳男性、2002 年にふらつきで発症し、体幹失調と右舌下神経麻痺を認めた。右 VA に壁内出血を伴う部分血栓化動脈瘤を認め(28mm)、コイルによる母血管閉塞を施行した。治療後症状は軽快したが、半年後に体幹失調の再発と右 Horner 症候を認め、左 VA からの流入による動脈瘤の増大(32mm)と水頭症を認めた。左 VA からの動脈瘤の塞栓術と後頭下減圧開頭術により症状は軽快した。2004 年に動脈瘤の再開通はあったが、症状は安定していた。しかし 2005 年には症状が再燃悪化した。動脈瘤は右 VA の vasa vasorum(VV)より造影され、再増大(39mm)しており、開頭により近位部の右 VA 結紮術を施行した。しかし対側 VA 造影で遠位の VV から造影されるため同部をコイルで閉塞した。その後 VP shunt により症状は軽快したが、体幹失調は継続している。
【結論】VAFA はコイルによる閉塞で根治できることが多いが、部分血栓化した巨大な例では VV による再開通の可能性があり、治療法の選択に一考を要する。

MEMO

クリッピング後に再発した動脈瘤に対するコイル塞栓術

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脳神経外科

保谷　克巳

現在では一般的でないクリップを使用して再発した動脈瘤に対してコイル塞栓術を施行した2例を報告する。症例1．69才女性。20年以上前にくも膜下出血となり、他院でクリッピング術施行され、今回くも膜下出血を再発した。クリップはハイフェッツ型を使用。直達手術でクリップをはずす必要が出てきた場合専用の鉗子がないことから、コイル塞栓術を施行することになった。Neck が広く、double catheter 法と balloon による neckplasty を併用した。術後、問題なく独歩退院。瘤の再発を若干認めており経過観察中である。症例2．56才女性。5年前にくも膜下出血で発症。瀬川クリップを使用。Follow up にて動脈瘤の再発を認め、次第に大きくなってきたため治療することとなった。瀬川クリップに関しては適当なはずす道具がないため、コイル塞栓術を選択した。塞栓術の際、若干 neck が残存した。頭部単純撮影ではコイルの変形をみとめ再発が示唆されたが、follow up は途絶えている。結論　クリッピング術後に再発した動脈瘤にクリッピングを再施行する際、以前のクリップをはずす必要性が出てくることがある。瘤周囲の癒着のため、一般的な杉田クリップなどでもこれは容易ではない。今回の2例のような、特殊なクリップを使用した後再発した動脈瘤に対する治療はコイル塞栓術が第一に考慮されるべきである。

MEMO

睡眠時無呼吸症候群を伴う椎骨動脈瘤の一例

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平戸　政史[1]
内藤　　功[2]

【症例】40歳、男性。睡眠時無呼吸症候群にてnasal CPAPを使用中。5年前、脳ドックにて右椎骨動脈瘤を指摘されていたが、治療を希望せず経過観察となっていた。平成17年2月動脈瘤の治療を希望され当科受診。平成17年7月脳血管造影にて右椎骨動脈に嚢状動脈瘤を認めた。睡眠時無呼吸症候群のためnasal CPAPを使用しており、開頭術後の下位脳神経麻痺による呼吸障害の可能性が危惧されたため、塞栓術を行うこととなり、平成18年2月8日入院。2月16日全身麻酔下にてcoil塞栓術を施行した。術後は、半覚醒のまま未抜管でICUに入室となり、ディプリバンによる鎮静下にて呼吸管理を行った。翌2月17日ディプリバン投与を中止し、完全に覚醒したところで抜管したが、呼吸障害等は見られなかった。術後の経過は良好で、平成18年2月25日神経学的に脱落なく退院となった。
【結語】睡眠時無呼吸症候群を伴った椎骨動脈瘤の一例を報告した。動脈瘤が睡眠時無呼吸症候群に関与していたかは不明であるが、血管内手術を選択し下位脳神経障害が出現することなく、良好な結果を得ることができた。

MEMO

後方向き前交通動脈瘤に対する瘤内塞栓術の問題点

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近藤　勉[1]

【はじめに】後方向きの前交通動脈瘤に対する直達手術は、前交通動脈より分枝する穿通枝が確認しにくく、瘤内塞栓術を行う機会が増えているものと思われる。しかし、血管内治療においても動脈瘤内へのマイクロカテーテルの誘導が困難などの問題点も多い。今回、血管内治療を施行した後方向き前交通動脈瘤についての問題点を検討した。

【対象】2000年1月から2006年3月までに当院で施行した、脳動脈瘤塞栓術症例104例のうち前交通動脈瘤は20例であった。このうち後方向きの前交通動脈瘤は3例で、これらの症例について検討した。

【結果】後方向きの前交通動脈瘤症例において、全例瘤内塞栓術が完遂され、術中破裂は認めず、塞栓率は平均20.7%であった。しかし、前大脳動脈（A1）の長軸と動脈瘤の軸に段差が生じることが多く、親血管の長軸に沿って進むマイクロカテーテルの特性のため瘤内へのカテーテル誘導が困難でありさらに、コイルを留置する際、マイクロカテーテルの先端は不安定であった。また瘤内塞栓の最終段階で、マイクロカテーテルが瘤外へ逸脱すると、瘤内への再誘導がきわめて困難であった。

【結語】後方向き前交通動脈瘤は、血管撮影上一見、塞栓術が容易と思われる症例でも、カテーテルの誘導が困難であることが多く、tight packingとなりにくい。このため、再発を来しやすいと思われ、術後の厳重な経過観察が必要と考えられる。

MEMO

中大脳動脈瘤の塞栓例

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【目的】中大脳動脈瘤に対しコイル塞栓術を施行した自検例を報告し、適応・、直達手術との比較、手技などについて検討した。
【対象】2004年4月から2005年12月までにコイル塞栓術を施行した中大脳動脈瘤の3例で2例は破裂瘤、1例は未破裂瘤、全員女性。
【結果】①症例1は頚部が狭く密な塞栓が可能との判断のもと破裂瘤の塞栓を施行した。その結果、密な塞栓が得られ約1年の経過でコイルコンパクションは認めていない。②症例2は頚部が広い未破裂瘤で患者の希望によりダブルカテーテルテクニックを併用し塞栓術を施行した。③症例3は高齢者、石灰化を有した不整形の破裂瘤で周辺との癒着の可能性があり、コイル塞栓術を選択した。結果的には頚部が広く疎な塞栓術後、後日再塞栓を追加施行した。
【結論】中大脳動脈瘤は頚部が広く密な塞栓が難しい例も多いが、頚部が狭い例や直達手術での侵襲が高いと予想される例においてはオプションとしては有用と考えられる。

MEMO

脳動脈瘤治療 in Paris

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フランス・パリの Hopital de la Fondation Rothschild では、脳動脈瘤治療は、全て塞栓術を含むインターベンションで治療を行っている。脳動脈瘤の部位は、頭蓋内のすべての動脈瘤である。ほぼ全例に、Neck plasty balloon を用い、コイルは、Matrix-2®(Boston Scientific)、GDC-10®,-18®(Boston Scientific)、Trufill DCS® (Cordis)、Nexus®(MTI) などである。特に、Broad Neck aneurysm や IC dorsal、IC-opth. aneurysm では、LEO stent ®(BALT)、Neuro-form 3®(Boston Scientific) を併用し、コイル塞栓術を施行。前大脳動脈瘤や中大脳動脈瘤に対しては、可能なかぎり Neck plasty balloon 併用のコイル塞栓術を施行。解離性椎骨動脈瘤に対しても、上記 stent を用い治療を行っている。

MEMO

ステントを併用し治療した破裂解離性椎骨動脈瘤の1例

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【はじめに】本邦においても、ステント併用による動脈瘤治療例の報告が散見される。今回あらかじめ挿入しておいたカテよりステント併用下にコイル塞栓術を施行した、解離性椎骨動脈瘤の1例を経験したので報告する。

【症例】70歳の男性。突然の頭痛で発症し、2日後に近医を受診しCT検査を施行したが異常なしと診断された。翌日も頭痛消失せず、腰椎穿刺により血性髄液を認めクモ膜下出血の診断となった。既往歴：12年前他院にて右椎骨動脈瘤の診断でcoating術を施行されている。血管造影検査で前回の手術部位と考えられる、右椎骨動脈(VA)に血管壁不整の動脈瘤を認め、解離性動脈瘤の診断となった。対側VAは低形成であり、右VAの血流を温存すべくステント併用治療を選択した。ドライバーステント4mm X 18cmを解離部位をブリッジするように留置し、stent in coilで瘤内塞栓術を追加した。術後、最も拡張した近位部の瘤は消失し、その後の経過観察の血管造影検査でも同様で、経過も良好である。

【考察】ステントメッシュ間からのコイル塞栓術では近位部瘤への十分なコイル充填が困難であり、本例の如く、あらかじめカテを挿入しておく方法が有用と考えられた。ドライバーステントは追従性に優れ、頭蓋内血管への挿入は比較的容易であるがやはり、自己拡張型ステントの方が安全と考える。

MEMO

脳動脈瘤塞栓術における HyperForm Balloon Catheter の使用経験

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【目的】HyperForm Balloon Catheter(HFB)は、極めて compliance の高いバルーンを有し、従来の compliance が低いバルーンを用いた remodeling 法では治療困難と思われる脳動脈瘤に対しても塞栓術が可能である。我々は、HFB を積極的に用いて塞栓術を行っており、その治療成績と問題点を検討し報告する。
【対象】HFB が本邦で使用可能となった 2004 年 6 月より 2006 年 4 月までの 1 年 11 ヶ月間に、当院および関連施設において施行した瘤内塞栓術は 274 例 284 瘤であり、そのうち HFB を用いて remodeling 法を行った 50 例 51 瘤（破裂 24、未破裂 24、再塞栓 3）を対象とした。動脈瘤の局在は、内頸動脈 18、前交通動脈 8、中大脳動脈 10、脳底動脈先端部 9、上小脳動脈 3、前大脳動脈水平部 1、後下小脳動脈 1、脳底動脈本幹 1 であった。
【方法】全例、全身麻酔下にヘパリン化を行い GDC ないし Trufill DCS による塞栓術を行った。
【結果】治療直後の塞栓結果は、完全閉塞 33(64.7%)、柄部残存 13(25.5%)、不完全閉塞 5(9.8%)であった。合併症は 4 手技に認められたが HFB に直接関連したものは 3 であった。これら合併症による morbidity/mortality は無かった。
【結論】HFB は、compliance が高く bifurcation 部や細径の親動脈に発生した動脈瘤でも使用でき、また、意図的に瘤内へバルーンを突出させる事で瘤の柄部ないし体部から起始する分枝を温存できる。ただし、従来の remodeling 法と同様、術中破裂、血管解離、血管攣縮、血栓塞栓症の可能性があり、その使用には、術者が標準的瘤内塞栓術だけでなく、従来の remodeling 法にも充分に習熟している必要性がある。

Key words: cerebral aneurysm, remodeling technique, hyperform balloon catheter

MEMO

文献レビュー参考文献 abstract 集

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International subarachnoid aneurysm trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised comparison of effects on survival, dependency, seizures, rebleeding, subgroups, and aneurysm occlusion.

Molyneux AJ, Kerr RS, Yu LM, Clarke M, Sneade M, Yarnold JA, Sandercock P; International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group.

Lancet. 2005 Sep 3-9;366(9488):809-17. Comment in: Lancet. 2005 Sep 3-9;366(9488):783-5.

BACKGROUND: Two types of treatment are being used for patients with ruptured intracranial aneurysms: endovascular detachable-coil treatment or craniotomy and clipping. We undertook a randomised, multicentre trial to compare these treatments in patients who were suitable for either treatment because the relative safety and efficacy of these approaches had not been established. Here we present clinical outcomes 1 year after treatment. METHODS: 2143 patients with ruptured intracranial aneurysms, who were admitted to 42 neurosurgical centres, mainly in the UK and Europe, took part in the trial. They were randomly assigned to neurosurgical clipping (n=1070) or endovascular coiling (n=1073). The primary outcome was death or dependence at 1 year (defined by a modified Rankin scale of 3-6). Secondary outcomes included rebleeding from the treated aneurysm and risk of seizures. Long-term follow up continues. Analysis was in accordance with the randomised treatment. FINDINGS: We report the 1-year outcomes for 1063 of 1073 patients allocated to endovascular treatment, and 1055 of 1070 patients allocated to neurosurgical treatment. 250 (23.5%) of 1063 patients allocated to endovascular treatment were dead or dependent at 1 year, compared with 326 (30.9%) of 1055 patients allocated to neurosurgery, an absolute risk reduction of 7.4% (95% CI 3.6-11.2, p=0.0001). The early survival advantage was maintained for up to 7 years and was significant (log rank p=0.03). The risk of epilepsy was substantially lower in patients allocated to endovascular treatment, but the risk of late rebleeding was higher. INTERPRETATION: In patients with ruptured intracranial aneurysms suitable for both treatments, endovascular coiling is more likely to result in independent survival at 1 year than neurosurgical clipping; the survival benefit continues for at least 7 years. The risk of late rebleeding is low, but is more common after endovascular coiling than after neurosurgical clipping

Treatment of ruptured intracranial aneurysms since the International Subarachnoid Aneurysm Trial: practice utilizing clip ligation and coil embolization as individual or complementary therapies.

Lanzino G, Fraser K, Kanaan Y, Wagenbach A.

J Neurosurg. 2006 Mar;104(3):344-9. Comment in J Neurosurg. 2006 Mar;104(3):341-3; discussion 343.

OBJECT: The aim of this study was to analyze the therapeutic decision-making process and outcome in 100 consecutive patients with aneurysmal subarachnoid hemorrhage (SAH) treated since the completion of the International Subarachnoid Aneurysm Trial (ISAT). All patients were evaluated and treated by a neurosurgeon with subspecialty training in both cerebrovascular and neuroendovascular surgery. METHODS: One hundred consecutive patients with aneurysmal SAH who had been admitted within 1 week posthemorrhage and who had been treated using either surgical clip application or endovascular coil embolization were included in this analysis. All patients underwent a uniform perioperative protocol. All surviving patients were given a questionnaire to assess their modified Rankin Scale score (mRS) and to grade themselves at 6 months and 1 year postintervention. The cohort consisted of 73 women and 27 men with a mean age of 57.27 years (range 27-87 years). Twenty-nine percent of the patients had a World Federation of Neurosurgical Societies (WFNS) Grade IV or V SAH. Forty-seven patients underwent direct surgical clip application, 41 endovascular embolization, and 12 a combination of the two procedures. Good functional outcome--indicated by mRS scores of 0 to 2 after at least 6 months--was achieved in 71% of patients. CONCLUSIONS: Data from the ISAT demonstrated a better functional outcome following endovascular embolization in a selected group of patients with aneurysmal SAH. In routine clinical practice, however, a significant number of patients still benefit from direct surgical clip ligation. Excellent functional results can be realized in a complementary clip ligation and coil occlusion practice in which each patient and aneurysm is evaluated and the two treatment modalities are used individually or, when needed, in combination.

Endovascular coiling versus neurosurgical clipping for patients with aneurysmal subarachnoid haemorrhage.

van der Schaaf I, Algra A, Wermer M, Molyneux A, Clarke M, van Gijn J, Rinkel G.

Cochrane Database Syst Rev. 2005 Oct 19;(4):CD003085.

BACKGROUND: Patients who have had an aneurysmal subarachnoid haemorrhage (SAH) are at very high risk of rebleeding if the aneurysm is not treated. The standard treatment for several decades has been surgical clipping of the neck of the aneurysm. In recent years, an alternative, the introduction of detachable coils to occlude the aneurysm, has become more common. OBJECTIVES: To compare the effects of endovascular coiling versus neurosurgical clipping in patients with aneurysmal subarachnoid haemorrhage. SEARCH STRATEGY: We searched the Cochrane Stroke Group Trials Register (last searched in February 2005). In addition we searched MEDLINE (1966 to January 2004) and EMBASE (1980 to January 2004), and contacted trialists. SELECTION CRITERIA: We included randomised trials in which endovascular coiling of aneurysms was compared with neurosurgical clipping in patients with SAH who have proven aneurysm. DATA COLLECTION AND ANALYSIS: Two authors independently extracted the data and assessed trial quality. Trialists were contacted to obtain missing information. MAIN RESULTS: We identified three randomised trials: two published and one unpublished. The trials included a total of 2272 patients (range per trial: 20 to 2143 patients). Most of the patients were in good clinical condition and had an aneurysm on the anterior circulation. After one year of follow up, the relative risk (RR) of poor outcome for coiling versus clipping was 0.76 (95% confidence interval (CI) 0.67 to 0.88). The absolute risk reduction was 7% (95% CI 4% to 11%). In the worst-case scenario analysis for poor outcome overall, the relative risk for coiling versus clipping was 0.81 (95% CI 0.70 to 0.92) and the absolute risk reduction was 6% (95% CI 2% to 10%). For patients with anterior circulation aneurysm the relative risk of poor outcome was 0.78 (95% CI 0.68 to 0.90) and the absolute risk decrease was 7% (95% CI 3% to 10%). For those with a posterior circulation aneurysm the relative risk was 0.41 (95% CI 0.19 to 0.92) and the absolute decrease in risk 27% (95% CI 6% to 48%). AUTHORS' CONCLUSIONS: The evidence comes mainly from one large trial. For patients in good clinical condition with ruptured aneurysms of either the anterior or posterior circulation we have firm evidence that, if the aneurysm is considered suitable for both surgical clipping and endovascular treatment, coiling is associated with a better outcome.

Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment.

Wiebers DO, Whisnant JP, Huston J 3rd, Meissner I, Brown RD Jr, Piepgras DG, Forbes GS, Thielen K, Nichols D, O'Fallon WM, Peacock J, Jaeger L, Kassell NF, Kongable-Beckman GL, Torner JC; International Study of Unruptured Intracranial Aneurysms Investigators.

Lancet. 2003 Jul 12;362(9378):103-10. Comment in: Lancet. 2003 Jul 12;362(9378):90-1. Surg Neurol. 2004 Aug;62(2):95.

BACKGROUND: The management of unruptured intracranial aneurysms is controversial. Investigators from the International Study of Unruptured Intracranial Aneurysms aimed to assess the natural history of unruptured intracranial aneurysms and to measure the risk associated with their repair. METHODS: Centres in the USA, Canada, and Europe enrolled patients for prospective assessment of unruptured aneurysms. Investigators recorded the natural history in patients who did not have surgery, and assessed morbidity and mortality associated with repair of unruptured aneurysms by either open surgery or endovascular procedures. FINDINGS: 4060 patients were assessed-1692 did not have aneurysmal repair, 1917 had open surgery, and 451 had endovascular procedures. 5-year cumulative rupture rates for patients who did not have a history of subarachnoid haemorrhage with aneurysms located in internal carotid artery, anterior communicating or anterior cerebral artery, or middle cerebral artery were 0%, 2. 6%, 14 5%, and 40% for aneurysms less than 7 mm, 7-12 mm, 13-24 mm, and 25 mm or greater, respectively, compared with rates of 2 5%, 14 5%, 18 4%, and 50%, respectively, for the same size categories involving posterior circulation and posterior communicating artery aneurysms. These rates were often equalled or exceeded by the risks associated with surgical or endovascular repair of comparable lesions. Patients' age was a strong predictor of surgical outcome, and the size and location of an aneurysm predict both surgical and endovascular outcomes. INTERPRETATION: Many factors are involved in management of patients with unruptured intracranial aneurysms. Site, size, and group specific risks of the natural history should be compared with site, size, and age-specific risks of repair for each patient.

Aggregate analysis of the literature for unruptured intracranial aneurysm treatment.

Lee T, Baytion M, Sciacca R, Mohr JP, Pile-Spellman J.

AJNR Am J Neuroradiol. 2005 Sep;26(8):1902-8.

BACKGROUND: Publication bias and/or true heterogeneity can skew aggregate impressions from scientific literature. To better determine aggregate measures for unruptured intracranial aneurysm (UIA) treatment, we analyzed adverse outcome rates of surgical clipping and endovascular coil embolization. METHODS: Two independent reviewers searched MEDLINE for studies publishing adverse outcome rates for endovascular coiling and surgical clipping between January 1990 and July 2003. Studies were classified as single-center, multicenter, or community-based. We defined adverse outcome rates as combined all-cause early or in-hospital morbidity and mortality. We determined cumulative adverse outcome rates by plotting precision measure (sample size) against trial-specific effect (adverse outcome rate). FINDINGS: We included 4 endovascular coiling multicenter/community-based studies (1019 patients) and 13 single-center studies (810 patients) and 5 surgical clipping multicenter/community-based studies (10,541 patients) and 23 single-center studies (1759 patients). Cumulative adverse outcome rates for endovascular coiling and surgical clipping were 8.8% (95% confidence interval [CI] 7.6%-10.1%) and 17.8% (95% CI 17.2%-18.6%). INTERPRETATION: Scattergram distribution illustrated the magnitude of bias in current literature reporting UIAs. Major parts of the literature may have underestimated surgical clipping morbidity and mortality, which can be attributed to bias from smaller retrospective studies. Neuroradiologic coiling studies were less likely to include factors contributing to inaccurate adverse outcome rates.

Treatment of unruptured cerebral aneurysms by embolization with guglielmi detachable coils: case-fatality, morbidity, and effectiveness in preventing bleeding--a systematic review of the literature.

Lanterna LA, Tredici G, Dimitrov BD, Biroli F.

Neurosurgery. 2004 Oct;55(4):767-75; discussion 775-8.

OBJECTIVE: Guglielmi detachable coils (GDCs) increasingly are being used to treat unruptured cerebral aneurysms (UCAs). We systematically reviewed the literature to assess the case-fatality and permanent morbidity rates of GDC embolization of UCAs and the postembolization bleeding rate. METHODS: Through a MEDLINE search of the English, Italian, and French literature from January 1990 through December 2002, we retrieved studies on GDC embolization of aneurysms and extracted data on UCAs. Inclusion criteria were: 1) attempted GDC embolization of at least five consecutive patients with UCAs, 2) reported percentage of at least either case-fatality or permanent morbidity rate or crude data allowing an independent calculation. When data on UCAs could not be characterized with certainty among data on other, different lesions, the study was rejected. RESULTS: We included 30 studies. One thousand three hundred seventy-nine patients were available for the calculation of the case-fatality rate, 794 for the permanent morbidity rate, and 703 for the bleeding rate. The case-fatality rate was 0.6% (95% confidence interval, 0.2-1%), the permanent morbidity rate was 7% (95% confidence interval, 5.3-8.7%), and the bleeding rate was 0.9% per year (95% confidence interval, 0.41-1.4%). Only incompletely coiled UCAs of 10 mm or more accounted for the bleeding events. Morbidity decreased from 8.6% to 4.5% ($P < 0.05$) when the midyear of study (average calendar year of treatment) was 1995 or later. CONCLUSION: GDC embolization of UCAs is relatively safe, and the outcome is progressively improving. Partial embolization of UCAs of 10 mm or more is unlikely to provide an acceptable protection. Most of the source publications suffer from methodological weaknesses. Prospective studies with longer follow-up periods are needed to definitively assess the effectiveness of GDCs on UCAs.

Age-dependent differences in short-term outcome after surgical or endovascular treatment of unruptured intracranial aneurysms in the United States, 1996-2000.

Barker FG 2nd, Amin-Hanjani S, Butler WE, Hoh BL, Rabinov JD, Pryor JC, Ogilvy CS, Carter BS.

Neurosurgery. 2004 Jan;54(1):18-28; discussion 28-30.

INTRODUCTION: Unruptured intracranial aneurysm patients are frequently eligible for both open surgery ("clipping") and endovascular repair ("coiling"). We compared short-term end points (mortality, discharge disposition, complications, length of stay, and charges) for clipping and coiling in a nationally representative discharge database. METHODS: We conducted a retrospective cohort study using Nationwide Inpatient Sample data from 1996 to 2000. Multivariate logistic regression analyses adjusted for age, sex, race, payer status, geographic region, presenting signs and symptoms, admission type and source, procedure timing, hospital caseload, and possible clustering of outcomes within hospitals. The results were confirmed by performing propensity score analysis. RESULTS: A total of 3498 patients had clipping, and 421 underwent coiling. Clipped patients were slightly younger ($P < 0.001$). Medical comorbidity was similar between the groups. More clipped patients had urgent or emergency admissions ($P = 0.02$). More coiling procedures were performed on hospital Day 1 ($P = 0.007$). When only death and discharge to long-term care were counted as adverse outcomes, there was no significant difference between clipping and coiling. On the basis of a four-level discharge status outcome scale (dead, long-term care, short-term rehabilitation, or discharge to home), coiled patients had a significantly better discharge disposition (odds ratio, 2.1; $P < 0.001$). With regard to patient age, most of the difference in discharge disposition was in patients older than 65 years of age. The degree of difference between treatments increased from 1996 to 2000. Neurological complications were coded twice as frequently in clipped patients as in coiled patients ($P = 0.002$). Length of stay was longer (5 d versus 2 d, $P < 0.001$) and charges were higher ($21,800 versus $13,200, $P = 0.007$) for clipped patients than for coiled patients. CONCLUSION: There was no significant difference in mortality rates or discharge to long-term facilities after clipping or coiling of unruptured aneurysms. When discharge to short-term rehabilitation was counted as an adverse event, coiled patients had significantly better outcomes than clipped patients at the time of hospital discharge, but most of the coiling advantage was concentrated in patients older than 65 years of age. Even in older patients, long-term end points-including long-term functional status in patients discharged to rehabilitation and efficacy in preventing hemorrhage-will be critical in determining the best treatment option for patients with unruptured aneurysms.

（関連文献）

A multicenter study of 705 ruptured intracranial aneurysms treated with Guglielmi detachable coils.
Gallas S, Pasco A, Cottier JP, Gabrillargues J, Drouineau J, Cognard C, Herbreteau D.
AJNR Am J Neuroradiol. 2005 Aug;26(7):1723-31.

Treatment of unruptured aneurysms with GDCs: clinical experience with 247 aneurysms.
Gonzalez N, Murayama Y, Nien YL, Martin N, Frazee J, Duckwiler G, Jahan R, Gobin YP, Vinuela F.
AJNR Am J Neuroradiol. 2004 Apr;25(4):577-83.

Endovascular coil occlusion of 1811 intracranial aneurysms: early angiographic and clinical results.
Henkes H, Fischer S, Weber W, Miloslavski E, Felber S, Brew S, Kuehne D.
Neurosurgery. 2004 Feb;54(2):268-80; discussion 280-5.

Guglielmi detachable coil embolization of cerebral aneurysms: 11 years' experience.
Murayama Y, Nien YL, Duckwiler G, Gobin YP, Jahan R, Frazee J, Martin N, Vinuela F.
J Neurosurg. 2003 May;98(5):959-66.

Aneurysmal rupture during coiling: low incidence and good outcomes at a single large volume center.

Brisman JL, Niimi Y, Song JK, Berenstein A.

Neurosurgery. 2005 Dec;57(6):1103-9; discussion 1103-9.

OBJECTIVE: To study the incidence and clinical outcomes of intraoperative aneurysm rupture (IOR) during endovascular coil embolization at a single large volume center and to review the literature on this subject to determine whether IOR rupture rate and mortality correlate with volume of aneurysms treated at a given center and years since the institution of Guglielmi detachable coils as a treatment modality. METHODS: We reviewed the aneurysm database at the Center for Endovascular Surgery since its inception (1997-2003) and reviewed 600 consecutively treated intracranial aneurysms in which coiling was attempted. All patients who sustained an IOR were studied. Procedural and follow-up angiograms as well as clinical outcomes were retrospectively reviewed. A literature review was conducted. RESULTS: Six patients (1.0%) experienced IOR (1.4% in acutely ruptured lesions, 0% in unruptured). All six had presented with diffuse subarachnoid hemorrhage (Fisher Grade 3) and in good clinical grade (Hunt & Hess Grades 1-3). One patient was rendered permanently disabled secondary to delay in controlling the IOR. All others were neurologically unchanged. A review of the literature revealed a trend in correlation between volume of aneurysms treated and IOR rate; no statistically significant correlation was found between volume of aneurysms treated or years since the introduction of GDC technology and IOR rates or mortality. CONCLUSION: IOR remains a serious risk of endosaccular coiling of intracranial aneurysms, with aneurysms presenting with subarachnoid hemorrhage at greater risk for this complication. This risk can be minimized with very low associated morbidity and mortality (incidence 1%, 17% morbidity, 0% mortality at our institution).

Early rebleeding after coiling of ruptured cerebral aneurysms: incidence, morbidity, and risk factors.

Sluzewski M, van Rooij WJ.

AJNR Am J Neuroradiol. 2005 Aug;26(7):1739-43.

BACKGROUND AND PURPOSE: The purpose of this study was to assess the incidence of early rebleeding after coiling of a ruptured cerebral aneurysm, assess the clinical outcome, and identify risk factors for this event. METHODS: Early rebleedings occurred in 6/431 (1.4%) consecutive patients after coiling of a ruptured aneurysm. Clinical condition at the time of treatment, aneurysm location and size, initial aneurysm occlusion, timing of coiling, and the presence of an adjacent intracerebral hematoma in the six patients with early rebleedings were compared with the remaining 425 patients. RESULTS: Incidence of early rebleeding after coiling of a ruptured aneurysm was 1.4%, and mortality was 100%. Independent risk factors are the presence of an adjacent intracerebral hematoma and small aneurysm size. Dependent risk factors are location on the anterior communicating artery, initial incomplete aneurysm occlusion, and poor clinical condition at the time of treatment. CONCLUSION: Early rebleeding after coiling of ruptured aneurysms is a major concern, in particular because the mortality is very high. A more restricted postembolization anticoagulation strategy in high-risk aneurysms may possibly prevent the occurrence of this devastating event.

Thromboembolic events associated with Guglielmi detachable coil embolization of asymptomatic cerebral aneurysms: evaluation of 66 consecutive cases with use of diffusion-weighted MR imaging.

Soeda A, Sakai N, Sakai H, Iihara K, Yamada N, Imakita S, Nagata I.

AJNR Am J Neuroradiol. 2003 Jan;24(1):127-32. Comment in: AJNR Am J Neuroradiol. 2004 Jan;25(1):159-60; author reply 160. AJNR Am J Neuroradiol. 2004 Nov-Dec;25(10):1861; author reply 1861-2.

BACKGROUND AND PURPOSE: Although Guglielmi detachable coil (GDC) endovascular treatment of intracranial aneurysms has become an accepted alternative to surgery, the main complication continues to be thromboembolic events. We sought to determine the frequency and radiologic appearance of thromboembolic events during GDC embolization for asymptomatic cerebral aneurysms by using diffusion-weighted (DW) MR imaging and to determine whether aneurysmal anatomic factors or use of the balloon-assisted technique affected the frequency. METHODS: In 74 patients, 79 asymptomatic cerebral aneurysms were treated with GDC embolizations at the National Cardiovascular Center from 1999 to 2001. Thirty-nine of these aneurysms (49%) were treated with the balloon-assisted technique. DW imaging was performed in 66 patients at 2-5 days after GDC embolization. All DW images were reviewed by two radiologists for depiction of abnormalities. RESULTS: DW images showed hyperintense lesions in 40 patients (61%), with 16 of these patients (40%) incurring neurologic deteriorations. Fifteen of the symptomatic patients (94%) fully recovered by discharge, and the remaining one experienced permanent deficits. Hyperintense lesions were detected more frequently in wide-neck (73%) or large (100%) aneurysms and in procedures that used the balloon-assisted technique (73%) than in small aneurysms (50%) or in procedures with the simple GDC method (49%). The occurrence of new lesions was significantly associated with use of the balloon-assisted technique and with aneurysm diameter in multivariate analysis ($P < .05$). CONCLUSION: In our experience, thromboembolic events related to the use of GDC embolization are relatively common, especially in wide-neck or large aneurysms or in association with the balloon-assisted technique. Although permanent deficits are rare, the high rate of thromboembolic events suggests that improvements in the technique such as the addition of antiplatelet agents and the development of new embolic materials are mandatory.

Effect on cerebral vasospasm of coil embolization followed by microcatheter intrathecal urokinase infusion into the cisterna magna: a prospective randomized study.

Hamada J, Kai Y, Morioka M, Yano S, Mizuno T, Hirano T, Kazekawa K, Ushio Y.

Stroke. 2003 Nov;34(11):2549-54. Epub 2003 Oct 16.

BACKGROUND AND PURPOSE: Vasospasm remains the leading cause of death and permanent neurological disability in patients with aneurysmal subarachnoid hemorrhage (SAH). The objective of our prospective randomized trial of coil embolization followed by intrathecal urokinase infusion into the cisterna magna (ITUKI therapy) was to test its effectiveness in preventing or alleviating the severity of ischemic neurological deficits caused by vasospasm. METHODS: We enrolled 110 patients with ruptured intracranial aneurysms eligible for coil embolization and randomly assigned them to embolization with (n=57) or without (n=53) ITUKI therapy performed within 24 hours of aneurysmal SAH. The incidence of symptomatic vasospasms and the clinical outcomes, based on the Glasgow Outcome Scale, 6 months after SAH onset were assessed. RESULTS: There were no side effects or adverse reactions attributable to ITUKI therapy. Symptomatic vasospasm occurred in 5 patients (8.8%) with and 16 (30.2%) without ITUKI therapy; the difference was significant (P=0.012). Although the mortality rate did not differ between the groups, patients with ITUKI therapy had significantly better outcomes than those without (P=0.036). CONCLUSIONS: Our results demonstrate that ITUKI therapy significantly reduced the occurrence of symptomatic vasospasm. Although it did not completely prevent vasospasms, ITUKI therapy resulted in a lower rate of permanent neurological deficits.

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The use of abciximab in the treatment of acute cerebral thromboembolic events during neuroendovascular procedures.
Velat GJ, Burry MV, Eskioglu E, Dettorre RR, Firment CS, Mericle RA.
Surg Neurol. 2006 Apr;65(4):352-8, discussion 358-9.

Anticoagulation regimes and their influence on the occlusion rate of aneurysms: an experimental study in rabbits.
Grunwald IQ, Romeike BF, Roth C, Struffert T, Eymann R, Reith W.
Neurosurgery. 2005 Nov;57(5):1048-55; discussion 1048-55.

Periprocedural morbidity and mortality associated with endovascular treatment of intracranial aneurysms.
Park HK, Horowitz M, Jungreis C, Genevro J, Koebbe C, Levy E, Kassam A.
AJNR Am J Neuroradiol. 2005 Mar;26(3):506-14.

Intracranial aneurysms treated with Guglielmi detachable coils: imaging follow-up with contrast-enhanced MR angiography.

Gauvrit JY, Leclerc X, Caron S, Taschner CA, Lejeune JP, Pruvo JP.

Stroke. 2006 Apr;37(4):1033-7. Epub 2006 Mar 9.

BACKGROUND AND PURPOSE: To compare the utility of contrast-enhanced MR Angiography (CE-MRA) with digital subtraction angiography (DSA) after endovascular treatment of intracranial aneurysms with Guglielmi detachable coils. METHODS: From April 1999 to August 2002, 106 patients with 107 aneurysms treated by endovascular coiling using Guglielmi detachable coils underwent simultaneous DSA and CE-MRA at follow-up (mean: 12.9 range: 5 to 27 months). DSA was performed as the standard reference. MR angiographic images were analyzed independently by 2 senior radiologists (J.-Y.G., S.C.) and DSA by a third radiologist (X.L.). Findings were assigned to 1 of 3 categories: complete obliteration (class 1), residual neck (class 2) and residual aneurysm (class 3). RESULTS: DSA at follow-up demonstrated 65 (60.6%) complete obliterations (group 1), 21 (19.7%) residual necks (group 2) and 21 (19.7%) residual aneurysms (group 3). One patient (0.9%) experienced aneurysm rebleed during the follow-up period. Among 101 assessable imaging comparisons, interobserver agreement was determined to be very good for CE-MRA (kappa=0.96) with only 4 discrepancies between both examiners. Comparison between CE-MRA and DSA showed an excellent agreement between techniques (kappa=0.93). Of the 21 with residual necks described on DSA, 20 were seen on CE-MRA. CE-MRA detected all 19 residual aneurysms. CONCLUSIONS: CE-MRA after selective embolization of intracranial aneurysm is useful and comparable to DSA in the assessment of aneurysmal recanalization either as residual neck or aneurysmal sac.

Predictors of angiographic changes in neck remnants of ruptured cerebral aneurysms treated with Guglielmi detachable coils.

Yamazaki T, Sonobe M, Nakai Y, Sugita K, Matsumaru Y, Yanaka K, Matsumura A.

Neurol Med Chir (Tokyo). 2006 Jan;46(1):1-9; discussion 9-10.

The angiographic changes in neck remnants of ruptured cerebral aneurysms treated with Guglielmi detachable coils (GDCs) were evaluated in the acute stage to analyze the important radiological and clinical factors. The clinical and radiological data of 37 patients with a residual neck of a ruptured cerebral aneurysm treated with GDC were reviewed. The angiographic changes on follow-up angiography were classified into three groups: recanalization of the neck remnant, progressive thrombosis, and unchanged. The effects of the clinical and angiographic findings, such as patient age, follow-up period, type of aneurysm (terminal type or side wall type), dome diameter, neck size, dome/neck ratio, obliteration rate, and volume embolization ratio were investigated. Recanalization of the neck remnant was observed in 18 of 37 cases, progressive thrombosis in nine, and unchanged in 10. The type of aneurysm, dome diameter, neck size, and volume embolization ratio were correlated with changes in the neck remnant. The aneurysm dome diameter and type of aneurysm were independent predictive factors for the recanalization of neck remnants on follow-up angiography. Dome diameter of less than 4.5 mm and volume embolization ratio of more than 31% in side wall aneurysms were likely to lead to progressive thrombosis.

Endovascular coil embolization of intracranial aneurysms: important factors related to rates and outcomes of incomplete occlusion.

Kole MK, Pelz DM, Kalapos P, Lee DH, Gulka IB, Lownie SP.

J Neurosurg. 2005 Apr;102(4):607-15.

OBJECT: The authors report on important factors that influenced clinical and angiographically demonstrated outcomes in patients treated using coil embolization. METHODS: This study included 160 consecutive patients who underwent endovascular coil embolization for treatment of intracranial aneurysms. Univariate and multivariate logistic regression analyses were performed to assess factors that influenced the immediate posttreatment angiographic result. Cox regression analysis was used to establish factors related to the occurrence of negative events as well as a curve indicating the time to a negative event. Negative events were defined as aneurysm remnant increase, repeated treatment, rebleeding, or death during periprocedural hospitalization. Seventy-three percent of the patients treated in this study were independent or demonstrated no deficit (Glasgow Outcome Scale [GOS] Score 4 or 5) at a mean follow up of 18.2 months. The annual delayed rebleeding rate was 0.45%. Fifty percent of patients (65 of 131) suffered a negative event within 13 +/- 14 months (standard deviation). Statistically significant factors associated with the occurrence of negative events were rupture status ($p = 0.0128$) and immediate posttreatment angiographic result ($p < 0.001$). Overall clinical outcome assessed using the GOS was significantly related to the immediate posttreatment angiographic result ($chi2 = 4.788$, $p = 0.029$). The immediate post-treatment angiographic results were significantly influenced by catheter stability ($p = 0.0012$), aneurysm geometry (that is, simple or complex, $p = 0.0053$), and aneurysm neck diameter ($p = 0.0205$). CONCLUSIONS: A good or excellent clinical outcome can be obtained in most patients treated using endovascular coil embolization of intracranial aneurysms. Note, however, that a significant number of patients treated using traditional platinum coils will harbor unstable aneurysm remnants or require repeated treatment.

Evaluation of the stability of small ruptured aneurysms with a small neck after embolization with Guglielmi detachable coils: correlation between coil packing ratio and coil compaction.

Kai Y, Hamada J, Morioka M, Yano S, Kuratsu J.

Neurosurgery. 2005 Apr;56(4):785-92; discussion 785-92.

OBJECTIVE: Because it is difficult to predict the compaction of Guglielmi detachable coils (GDCs) after endovascular surgery for aneurysms, we studied the relationship between the coil packing ratio and compaction. Here, we propose a simple method for the preoperative estimation of coil compaction. Using follow-up angiograms, we studied the timing and degree of coil compaction in small terminal and side-wall aneurysms with narrow necks. METHODS: We studied 62 patients with acute ruptured intracranial aneurysms that were small (<10 mm), had a small neck (<4 mm), and were coil embolized with GDC-10s. The aneurysmal volume was calculated using the equation $V = 4/3pi(a/2) \times (b/2) \times (c/2)$, where a, b, and c are the aneurysmal height, length, and width in millimeters, respectively. The coil volume was calculated using the equation $V = pi(p/2)2 \times l \times 10$, where p represents the GDC-10 coil diameter (0.25 mm) and l is the coil length. We recorded the maximum prospective coil length, L, as that corresponding with the volume of packed coils occupying 30% of the aneurysmal volume. Therefore, L was calculated as $L (cm) = 0.3 \times a \times b \times c$, and the coil packing ratio was expressed as packed coil length/L x 100. Angiographic follow-up studies were generally performed at 3 months and 1 and 2 years after endovascular surgery. We considered coil compaction exceeding 2 mm as major compaction and recorded minor compaction when it was less than 2 mm of the empty reappeared space in the embolized aneurysm. Aneurysmal location was recorded as terminal or side wall. RESULTS: Of the 62 patients, 16 (25.8%) manifested angiographic coil compaction (10 minor and 6 major compactions); the mean coil packing ratio was 51.9 +/- 13.4%. The mean coil packing ratio in the other 46 patients was 80.5 +/- 20.2%, and the difference was statistically significant ($P < 0.01$). In all 6 patients with major compaction, the mean packing ratio was less than 50% and all underwent re-embolization after a mean of 24.9 +/- 1.1 months. The 10 patients with minor compaction were conservatively treated, and the degree of compaction did not change during a mean period of 24 months. We detected 93.8% of the compactions within 12 months of coil placement. The aneurysm was of the terminal type in 5 of the 6 patients with major coil compaction. CONCLUSION: In patients who underwent embolization with GDC-10s of aneurysms that were small and had a small neck, the optimal coil packing ratio could be identified with the formula $0.3 \times a \times b \times c$. The probability of coil compaction was significantly higher when the coil packing ratio was less than 50%. To detect coil compaction after embolization, follow-up angiograms must be examined regularly for at least 12 months. To detect major coil compaction in patients with terminal type aneurysms, angiographic follow-up should not be shorter than 24 months.

Time-of-flight MR angiography targeted to coiled intracranial aneurysms is more sensitive to residual flow than is digital subtraction angiography.

Yamada N, Hayashi K, Murao K, Higashi M, Iihara K.

AJNR Am J Neuroradiol. 2004 Aug;25(7):1154-7.

BACKGROUND AND PURPOSE: For intracranial aneurysms treated with Guglielmi detachable coils, long-term follow-up is mandatory because coil compaction may occur and aneurysms may recur. The purpose of this study was to establish a noninvasive technique to visualize residual flow in coiled aneurysms. METHODS: We designed a 3D time-of-flight (3D-TOF) MR angiography (MRA) technique targeted to depict coiled aneurysms that employed a very short TE (1.54-1.60 ms) and a high spatial resolution (0.3 x 0.3 x 0.3 mm3 with zero-filling) to diminish spin dephasing. To diminish spin saturation, image volume was carefully positioned so that the neck of the targeted aneurysm was within 2 cm of the inflow portion along the stream of blood. Fifty-one MRA images of 39 coiled aneurysms in 39 patients were compared with digital subtraction angiography (DSA) images. DSA and MRA findings were interpolated retrospectively for parent and branch arteries' patency, as well as residual flow in aneurysms. In the latest 11 MR studies, a dark-blood 3D turbo spin-echo sequence was added to MRA to negate the effect high-signal-intensity thrombus. RESULTS: MRA visualized all parent and branch arteries with DSA confirmation. MRA visualized residual flow more frequently (38 studies) than did DSA (25 studies). Residual flow space visualized with MRA was always similar to or larger than that with DSA. The dark-blood sequence completely suppressed intraluminal high signal intensity on MRA images and confirmed that the high signal intensity was not due to thrombus. CONCLUSION: TOF MRA targeted to depict coiled intracranial aneurysms is noninvasive and superior to DSA in visualization of residual flow and, hence, useful for follow-up of coiled aneurysms.

（関連文献）

Evaluation of aneurysm stability after endovascular embolization with Guglielmi detachable coils: correlation between long-term stability and volume embolization ratio.
Yagi K, Satoh K, Satomi J, Matsubara S, Nagahiro S.
Neurol Med Chir (Tokyo). 2005 Nov;45(11):561-5; discussion 565-6.

Intracranial aneurysms treated with endovascular coils: detection of recurrences using unenhanced and contrast-enhanced transcranial color-coded duplex sonography.
Turner CL, Higgins JN, Gholkar A, Mendelow AD, Molyneux AJ, Kerr RS, Chawda S, Kirkpatrick PJ.
Stroke. 2005 Dec;36(12):2654-9. Epub 2005 Nov 3.

Diffusion and perfusion MRI in patients with ruptured and unruptured intracranial aneurysms treated by endovascular coiling: complications, procedural results, MR findings and clinical outcome.
Cronqvist M, Wirestam R, Ramgren B, Brandt L, Nilsson O, Saveland H, Holtas S, Larsson EM.
Neuroradiology. 2005 Nov;47(11):855-73. Epub 2005 Oct 19.

Endosaccular treatment of intracranial aneurysms using matrix coils: early experience and midterm follow-up.

Niimi Y, Song J, Madrid M, Berenstein A.

Stroke. 2006 Apr;37(4):1028-32. Epub 2006 Mar 2.

BACKGROUND AND PURPOSE: The authors report their experience using Matrix coils in the treatment of cerebral aneurysms. METHODS: The outcomes of 72 consecutive patients (76 aneurysms) who underwent coiling using Matrix coils at our institution were retrospectively analyzed. RESULTS: Seventy-four aneurysms in 70 patients were coiled using Matrix coils (ranging 3% to 100% by coil length; mean 68.8%). Two patients underwent regular platinum coil embolization after failed Matrix coil placement. Thirty-two (42%) ruptured aneurysms were acutely treated. In 46 aneurysms, Matrix composed >50% of coil length. Complete aneurysm occlusion was obtained in 13 aneurysms (17.6%), neck remnant in 30 (40.5%), and dome filling in 31 (41.9%). Procedural morbidity and mortality rates were 1.4% and 1.4%, respectively. Angiographic follow-up was obtained in 63.5% (47 of 74 aneurysms; average 12.2 months; range 0 to 34). In these 47 angiographically followed aneurysms, the overall recanalization rate was 57.4%. In aneurysms with >50% Matrix coils, 76.1% had angiographic follow-up (35 of 46), and in this group, the overall recanalization rate was 54.3% (19 of 35): 25% (1 of 4) for very small (<5 mm); 33% (4 of 12) for small-size (<10 mm)/small-neck (<4 mm); and 63% (5 of 8) for small-size/wide-neck (> or =4 mm). A total of 82% (9 of 11) recanalization occurred in large aneurysms (> or =10 to 25 mm). Ten aneurysms (21.3%; 10 of 47) underwent retreatment. Clinical follow-up was obtained in 61 (86%) patients (average 15 months; range 1 to 37): 87% of patients were Glasgow Outcome Scale 4 or 5. CONCLUSIONS: The use of Matrix coils resulted in worse recanalization rates than that reported for Guglielmi detachable bare platinum coils.

Histopathologic evaluation of aneurysms treated with Guglielmi detachable coils or matrix detachable microcoils.

Szikora I, Seifert P, Hanzely Z, Kulcsar Z, Berentei Z, Marosfoi M, Czirjak S, Vajda J, Nyary I.

AJNR Am J Neuroradiol. 2006 Feb;27(2):283-8.

BACKGROUND AND PURPOSE: The purpose of this study was to evaluate the degree of organization and fibrocellular tissue development in aneurysms treated with bare platinum or biologically active microcoils. METHODS: Twelve aneurysms were removed at autopsy between 1-18 days and another 2 between 2-3 months posttreatment. Four aneurysms were surgically removed between 6 months and 3 years following treatment. One aneurysm removed at 8 days and another at 6 months were treated with bioactive (Matrix) coils; the other 16 with bare platinum (Guglielmi detachable coils; GDCs). All specimens were embedded in plastic, stained with hematoxilin-eosin and elastin and examined by light microscopy. RESULTS: All specimens removed within 3 weeks demonstrated intra-aneurysmal thrombus, without signs of organization or fibrotic tissue formation over the neck regardless of the type of coils used. In the GDC-treated aneurysms, evidence of early thrombus organization was observed within 2-3 months, and completed yet imperfect fibrocellular reaction together with residual thrombus at 2-3 years. In the Matrix-treated specimens, the aneurysm cavity was completely filled with granulation tissue corresponding to still ongoing fibrocellular reaction at 6 months, including newly formed blood vessels, smooth muscle cells, and collagen deposition without signs of residual thrombus. CONCLUSIONS: Our results indicate that in aneurysms treated with bare platinum coils thrombus organization does not occur until late after treatment and may remain imperfect for years. In one aneurysm studied 8 days following treatment with Matrix coils, no difference was noted compared to aneurysms treated with bare platinum coils. In another aneurysm examined 6 months following packing with Matrix coils, the histologic changes support the hypothesis that the biologically active polymer may accelerate aneurysm healing.

Durability of aneurysm embolization with matrix detachable coils.

Fiorella D, Albuquerque FC, McDougall CG.

Neurosurgery. 2006 Jan;58(1):51-9; discussion 51-9.

OBJECTIVE: Matrix detachable coils (MDC; Boston Scientific/Target, Fremont, CA) are platinum coils coated with a bioabsorbable polymeric material (polyglycolic-polylactic acid). In animal models, the introduction of polyglycolic-polylactic acid-coated coils into experimental aneurysms resulted in a cellular reaction which promoted stable intra-aneurysmal scar tissue formation. The current study was undertaken to assess the durability of aneurysm occlusion after embolization with MDC. METHODS: All patients undergoing embolization were prospectively enrolled in an endovascular database at our institution. All coils used for embolization were recorded in the operative notes for the procedure. Only aneurysms embolized with 50% or greater length of MDC were included. All patients with Neuroform stents (Boston Scientific/Target, Fremont, CA) were excluded from the study. Patients were followed with conventional angiography and magnetic resonance angiography. RESULTS: During a 20-month period, 131 aneurysms were embolized with MDC. Follow up data (average, 6.9 mo; range, 1.5-22 mo) were available for 82 aneurysms (61 with conventional angiography, 21 with magnetic resonance angiography only). Of the aneurysm patients with follow-up available, 65 had small aneurysms with small necks, three were small aneurysms with wide necks, 12 were large aneurysms, and two were giant aneurysms. Overall, there were 30 (36.6%) recanalizations, 19 (23.1%) of which required retreatment. In two additional patients, retreatment was either recommended (n = 1) or attempted unsuccessfully (n = 1). Fifty-two aneurysms were unchanged or demonstrated progressive thrombosis (63.4%). The recanalization rate for small aneurysms with small necks was 26.1% (17 out of 65) with a 13.8% retreatment rate (9/65). The recanalization rate for large aneurysms was 75% (9 out of 12) with seven requiring retreatment. CONCLUSION: In the absence of Neuroform stent support, aneurysms embolized with the MDC system demonstrated a significant rate of recanalization. Many of the recanalizations were of sufficient size to warrant retreatment. The rates of recanalization observed in the present series were comparable to, or worse than, those reported for bare platinum coils.

Polyglycolide/polylactide-coated platinum coils for patients with ruptured and unruptured cerebral aneurysms: a single-center experience.

Linfante I, Akkawi NM, Perlow A, Andreone V, Wakhloo AK.

Stroke. 2005 Sep;36(9):1948-53. Epub 2005 Jul 28.

BACKGROUND AND PURPOSE: Recanalization of cerebral aneurysm is a limitation of bare platinum coils (BPCs). In a swine aneurysm model, polyglycolide/polylactide (a polymer)-coated platinum coils (Matrix) accelerated clot fibrosis and reduced recanalization rate and aneurysmal volume. We aimed to evaluate the safety of Matrix coils in patients with intracranial aneurysm. METHODS: This is a single-center, prospective study of patients with intracranial aneurysms treated with Matrix alone or in combination with BPCs. Follow-up evaluation included a 1-month clinical evaluation and a 6- and 12-month clinical and angiographic examination. Primary adverse events included death, stroke, and permanent neurological deficits. RESULTS: Between May 2002 and January 2004, 52 patients (range 34 to 79 years of age; 38 females) were treated for 54 aneurysms (size 7.9+/-4.6 mm; neck 3.9+/-1.5 mm; 26 ruptured). Matrix alone was used in 13 aneurysms. In 39, we used a combination of Matrix and BPCs. Twenty-one aneurysms had a 6-month follow-up examination (11 Matrix; 10 Matrix combined with bare platinum), and 11 completed the 12-month follow-up evaluation (Matrix only). Adverse events not related to the procedure were 2 deaths (ruptured basilar aneurysms) and 1 stroke at day 10 postcoiling secondary to vasospasm. Procedure-related adverse events were 2 strokes. At 6-month follow-up (n=21) evaluation, 2 of 3 recanalizations needed retreatment. At 12-month follow-up (n=11), there was no recanalization in patients treated with Matrix alone and no significant reduction in aneurysmal size. CONCLUSIONS: Polyglycolide/polylactide-coated coils had a satisfactory safety profile. Significant aneurysmal size reduction after coiling was not observed.

HydroCoil for Endovascular Aneurysm Occlusion (HEAL) study: periprocedural results.

Cloft HJ.

AJNR Am J Neuroradiol. 2006 Feb;27(2):289-92.

BACKGROUND AND PURPOSE: The HydroCoil Embolic System (HES) was developed to improve the efficacy of endovascular treatment of cerebral aneurysms. The purpose of this study is to study the periprocedural results in patients with cerebral aneurysms treated with HES. METHODS: We report the initial periprocedural results in 191 cerebral aneurysms treated with HES in the HydroCoil for Endovascular Aneurysm Occlusion, or HEAL, study. Initial aneurysm occlusion and periprocedural complication rates were evaluated and compared with historical control data regarding aneurysms treated with platinum coils. RESULTS: An initial occlusion result of "complete" or "near-complete" was achieved in 91.8% of aneurysms. Periprocedural thromboembolic events occurred in 8.1% of aneurysms treated with neurologic deficits related to thromboemboli occurring in 2.1% of aneurysms treated. Intraprocedural aneurysm perforations occurred in 2.8% of previously ruptured aneurysms, and in 0% of previously unruptured aneurysms. CONCLUSION: The initial occlusion success and complication rate when HES is used to treat cerebral aneurysms is not significantly different from platinum coils. Follow-up angiography is currently being collected and will be evaluated to determine if use of the HES reduces the rate of aneurysm recurrence.

（関連文献）

Short-term outcome of intracranial aneurysms treated with polyglycolic acid/lactide copolymer-coated coils compared to historical controls treated with bare platinum coils: a single-center experience.
Kang HS, Han MH, Kwon BJ, Kwon OK, Kim SH, Choi SH, Chang KH.
AJNR Am J Neuroradiol. 2005 Sep;26(8):1921-8.

Angiographic and histologic analysis of experimental aneurysms embolized with platinum coils, Matrix, and HydroCoil.
Ding YH, Dai D, Lewis DA, Cloft HJ, Kallmes DF.
AJNR Am J Neuroradiol. 2005 Aug;26(7):1757-63.

Three-dimensional packing with complex orbit coils for the endovascular treatment of intracranial aneurysms.
Lubicz B, Leclerc X, Gauvrit JY, Lejeune JP, Pruvo JP.
AJNR Am J Neuroradiol. 2005 Jun-Jul;26(6):1342-8.

Angiographic evidence of aneurysm neck healing following endovascular treatment with bioactive coils.
Gonzalez NR, Patel AB, Murayama Y, Vinuela F.
AJNR Am J Neuroradiol. 2005 Apr;26(4):912-4.

Changes in the intraaneurysmal pressure due to HydroCoil embolization.
Canton G, Levy DI, Lasheras JC.
AJNR Am J Neuroradiol. 2005 Apr;26(4):904-7.

Chemical meningitis after cerebral aneurysm treatment using two second-generation aneurysm coils: report of two cases.
Meyers PM, Lavine SD, Fitzsimmons BF, Commichau C, Parra A, Mayer SA, Solomon RA, Connolly ES Jr.
Neurosurgery. 2004 Nov;55(5):1222.

Three-dimensional rotational angiographic detection of in-stent stenosis in wide-necked aneurysms treated with a self-expanding intracranial stent.

Hoit DA, Malek AM.

Neurosurgery. 2005 Dec;57(6):1228-36; discussion 1228-36.

OBJECTIVE: To determine the effect of Neuroform stent (Boston Scientific/Target, Fremont, CA) deployment on parent vessel lumen and detect in-stent changes in patients harboring wide-necked intracranial aneurysms treated with the stent-coil technique. METHODS: Parent vessel dimensions were quantified before and after the procedure and at intermediate follow-up examinations by use of high-resolution three-dimensional rotational angiography. By use of shaded surface segmentation of the acquired volume, measurements of the parent vessel proximal to the stent (Point A), at three points within the stented vascular segment (Points B, C, and D), and distal to the stent (Point E) at each study time were compared by use of paired t tests. Correlation between degree of in-stent stenosis and reported ischemic events was estimated by use of a linear regression model. RESULTS: Stent and coil deployment had no immediate effect on parent vessel dimensions. At angiographic follow-up, there was no significant change in vessel size proximal to the stent. Within the stent and distal to it, however, there was a statistically significant 0.31- to 0.41-mm reduction in average diameter ($P < 0.001$, $P < 0.011$, $P < 0.003$, and $P < 0.014$ for Points B, C, D, and E, respectively). The highest degree of stenosis occurred at Point B, with an average decrease in cross sectional surface area of 2.4 mm ($P < 0.001$), corresponding to a 19% stenosis and 52% estimated increase in focal hemodynamic resistance by Poiseuille's law. No clinical correlation was noted with the degree of in-stent stenosis. CONCLUSION: Intracranial stenting using a soft self-expanding stent without angioplasty induced a statistically, but not clinically, significant decrease in cross sectional area. Further research and longer-term follow-up are needed to elucidate the mechanism and clinical importance of this response.

Buenos Aires experience with the Neuroform self-expanding stent for the treatment of intracranial aneurysms.

Lylyk P, Ferrario A, Pasbon B, Miranda C, Doroszuk G.

J Neurosurg. 2005 Feb;102(2):235-41.

OBJECT: The authors report their experience with the use of the Neuroform Microdelivery System for intravascular reconstruction. They assess the technical feasibility of the system, the efficacy of the combined application of stent and detachable coils, and the follow-up findings. METHODS: Fifty patients found to harbor a complex wide-necked intracranial aneurysm were selected for the study. Different strategies were chosen and the performance and technical success of the device were evaluated. Stent placement was recorded as optimal or suboptimal with respect to the stent position. Clinical and angiographic follow-up examinations were obtained. Forty-six patients with 48 intracranial aneurysms were treated, leading to a technical success rate of 92%. Forty-two lesions were located in the anterior circulation. In every case the dome/neck ratio was less than 2 and the mean aneurysm size in these patients was 8.8 mm. The most frequent clinical presentation was subarachnoid hemorrhage in 48% of cases. Stent placement was optimal in 81.2% of cases and suboptimal in 18.8%. In 31% of cases, the investigators encountered difficulties in placing the Neuroform stent. Clinical follow up was recorded in all patients and angiographic follow up was obtained in 63%. There were no cases of repeated hemorrhage. In a single case in which only the stent was implanted progressive thrombosis was identified during the follow-up period. The procedure-related morbidity and mortality rates were 8.6 and 2.1%, respectively. CONCLUSIONS: On the basis of the results, the authors conclude that the Neuroform self-expanding stent is a flexible and useful device that can be readily and safely maneuvered through tortuous intracranial vessels, enabling the endovascular treatment of complex wide-necked aneurysms. Early in the authors' experience, stent delivery presented difficulties; however, a second generation of devices has resolved this limitation. Although the early results are promising, the long-term benefit of this technique has to be proved by angiographic and clinical follow-up examinations.

（関連文献）

Preliminary experience with Leo self-expanding stent for the treatment of intracranial aneurysms.
Pumar JM, Blanco M, Vazquez F, Castineira JA, Guimaraens L, Garcia-Allut A.
AJNR Am J Neuroradiol. 2005 Nov-Dec;26(10):2573-7.

Initial clinical experience with a new self-expanding nitinol stent for the treatment of intracranial cerebral aneurysms: the Cordis Enterprise stent.
Higashida RT, Halbach VV, Dowd CF, Juravsky L, Meagher S.
AJNR Am J Neuroradiol. 2005 Aug;26(7):1751-6.

Usefulness of the Neuroform stent for the treatment of cerebral aneurysms: results at initial (3-6-mo) follow-up.
Fiorella D, Albuquerque FC, Deshmukh VR, McDougall CG.
Neurosurgery. 2005 Jun;56(6):1191-201; discussion 1201-2.

Cerebral Aneurysm Multicenter European Onyx (CAMEO) trial: results of a prospective observational study in 20 European centers.

Molyneux AJ, Cekirge S, Saatci I, Gal G.

AJNR Am J Neuroradiol. 2004 Jan;25(1):39-51.

BACKGROUND AND PURPOSE: This study was designed to investigate the safety and efficacy of the Onyx liquid embolic system in treating a selected population of patients with intracranial aneurysms that presented difficulties for surgical or endovascular alternatives. METHODS: A prospective observational study was conducted in 20 European centers enrolling a consecutive series of 119 patients with 123 aneurysms judged suitable for Onyx treatment. The series consists of findings collected in 97 of 119 patients with 100 of 123 aneurysms, because one center declined to provide data to the study sponsor or allow outside audit. Clinical and angiographic outcomes were recorded at discharge, 3 months, and 12 months. All adverse events and re-treatments were recorded. Seventy-nine aneurysms were large or giant. RESULTS: Twelve-month follow-up angiography findings were available for 71 aneurysms. This angiographic follow-up showed complete occlusion in 56 (79%) aneurysms, subtotal occlusion in nine (13%), and incomplete occlusion in six (8%). Procedure- or device-related permanent neurologic morbidity at final follow-up was present in eight of 97 patients. Seven patients died: two deaths were procedure related; one, disease related; and four, unrelated causes. Seventy-five of the 82 patients alive and with follow-up at 12 months were at Rankin 2 or better status. Delayed occlusion of the parent vessel occurred in nine patients; delayed occlusion was asymptomatic in five and resulted in permanent neurologic deficit in two. CONCLUSION: In selected patients with aneurysms that are unsuitable for coil treatment or in whom previous treatment has failed to occlude the aneurysm, Onyx treatment offers an endovascular alternative. Aneurysm occlusion rates are superior to reported rates of coil occlusion, and treatment morbidity is comparable to that of published prospective data on endovascular results for this subgroup of patients.

Treatment and follow-up of 22 unruptured wide-necked intracranial aneurysms of the internal carotid artery with Onyx HD 500.
Weber W, Siekmann R, Kis B, Kuehne D.
AJNR Am J Neuroradiol. 2005 Sep;26(8):1909-15.

Selective endovascular treatment of intracranial aneurysms with a liquid embolic: a single-center experience in 39 patients with 41 aneurysms.
Lubicz B, Piotin M, Mounayer C, Spelle L, Moret J.
AJNR Am J Neuroradiol. 2005 Apr;26(4):885-93.

Repeat endovascular treatment in post-embolization recurrent intracranial aneurysms.

Kang HS, Han MH, Kwon BJ, Kwon OK, Kim SH.

Neurosurgery. 2006 Jan;58(1):60-70; discussion 60-70.

OBJECTIVE: The purpose of this study was to describe clinical situations requiring repeat embolization in patients previously treated by endovascular coil embolization for intracranial aneurysms, and to report on our experiences of repeat embolization (RE). METHODS: A total of 466 patients harboring 522 intracranial aneurysms were treated by endovascular coil embolization at our institution during the period between December 1992 and August 2004. We studied 32 patients who underwent repeat coil embolization (RE) owing to recanalization or aneurysm recurrence. Radiological and clinical data were reviewed to determine the reasons, results, and technical problems of RE. RESULTS: Thirty-nine sessions of RE were performed in 32 patients; four patients underwent RE twice and another patient three times. The major reason for RE was asymptomatic aneurysmal recanalization owing to coil compaction and/or loosening. The time interval between RE and the previous embolization was 12 months or less in 27 sessions. Complete or near complete occlusion of the aneurysm was achieved in all cases without procedure-related morbidity or mortality. Radiolucent gaps between the coil masses were observed in 17 cases. CONCLUSION: RE is a safe and effective treatment option in cases of recanalized or recurrent aneurysms. Close follow-up evaluation is essential in patients with intracranial aneurysms after coil embolization.

Surgically treated aneurysms previously coiled: lessons learned.

Veznedaroglu E, Benitez RP, Rosenwasser RH.

Neurosurgery. 2004 Feb;54(2):300-3; discussion 303-5.

OBJECTIVE: Intravascular coil embolization of cerebral aneurysms has proved to be a safe and effective treatment in certain patient groups; however, this treatment is relatively new, and the long-term outcomes are unknown. One of the known complications is refilling of the aneurysm dome, which is seen in follow-up studies. This patient population poses unique technical difficulties for the neurosurgeon. We present a series of 18 patients who underwent surgery for residual aneurysms after coil remobilization. METHODS: During a 5-year period, we performed surgery in 18 patients who had previously undergone coil embolization for their aneurysms. Of these aneurysms, four were in the anterior communicating artery, five were in the posterior communicating artery, three were in the internal carotid artery, three were in the posteroinferior cerebellar artery, and three were in the middle cerebral artery. One patient presented with rupture, one presented with acute IIIrd cranial nerve palsy, and the rest of the aneurysms were found on routine follow-up angiograms. Fifteen aneurysms were clipped, and in three patients, they were wrapped because the clip could not be placed adequately. RESULTS: There were no major complications in any of the patients, and all had uneventful recoveries. The presence of coils in the aneurysm dome and/or neck made clipping and exposure of the aneurysm neck difficult, resulting in incomplete neck obliteration in three patients. CONCLUSION: Operative clipping after previous coil embolization in aneurysms poses a unique problem for neurosurgeons. With the increasing use of coil embolization, this patient population will undoubtedly increase. The neurosurgeon should be aware of the difficulties and pitfalls encountered in these patients.

Additional coiling of previously coiled cerebral aneurysms: clinical and angiographic results.
Slob MJ, Sluzewski M, van Rooij WJ, Roks G, Rinkel GJ.
AJNR Am J Neuroradiol. 2004 Sep;25(8):1373-6.

Balloon-in-stent technique for the constructive endovascular treatment of "ultra-wide necked" circumferential aneurysms.

Fiorella D, Albuquerque FC, Masaryk TJ, Rasmussen PA, McDougall CG.

Neurosurgery. 2005 Dec;57(6):1218-27; discussion 1218-27.

INTRODUCTION: Circumferential aneurysms, which incorporate >180 degrees of the circumference of the parent vessel, present a unique therapeutic challenge, particularly in circumstances in which a deconstructive treatment strategy is not feasible. We detail a novel technique for endovascular parent vessel reconstruction with aneurysm embolization. METHODS: We performed a retrospective review of the prospectively maintained databases of our two institutions to identify cases in which a balloon-in-stent technique had been used to treat circumferential aneurysms. During the first stage of this technique, a stent (Neuroform [Boston Scientific, Natick, MA], Multilink Vision [Guidant, Indianapolis, IN], or Bx Velocity [Cordis, New Brunswick, NJ]) is placed across the neck of the aneurysm to achieve parent vessel reconstruction. During the second stage, aneurysm coil embolization is performed with a compliant temporary occlusion balloon (Sentry [Boston Scientific, Natick, MA] or Hyperglide [Microtherapeutics, Irvine, CA]) placed within the stent to unambiguously demarcate and protect the parent vessel. In some cases, during the course of the embolization, coils project over and obscure the parent vessel in both working views. Before each coil detachment, the protection balloon is deflated under blank fluoroscopic roadmap visualization. The absence of shifting of any portion of the coil mass during balloon deflation indicates that the introduced coil is external to the stent-reconstructed parent vessel (i.e., within the aneurysm) and can be detached. This process is repeated until satisfactory aneurysm embolization is achieved. After embolization, the balloon catheter may be exchanged for a stent delivery system to facilitate the placement of a second stent. RESULTS: Seven patients underwent balloon-in-stent-assisted embolization over a 15-month period. Three were performed for internal carotid aneurysms, three for basilar trunk or basilar apex aneurysms, and one for a dissecting/fusiform V4 segment vertebral artery aneurysm. In three cases, the presence of the inflated balloon facilitated the manipulation of the image intensifier into a position which produced a "down-the-barrel" view of the parent vessel. In the four additional cases, for anatomic reasons, this view could not be achieved and coil mass projected over the reconstructed parent vessel in both views. Partial aneurysm occlusion (75-90%), was achieved in five cases, and near complete (>95%) occlusion was achieved in two cases. Complications included two significant retroperitoneal hematomas and two brainstem infarcts, both of which resulted in hemisensory symptoms. CONCLUSION: The balloon-in-stent technique provides a practical and safe treatment strategy for the management of circumferential aneurysms that are not amenable to deconstructive embolization.

Treatment of intracerebral hematomas caused by aneurysm rupture: coil placement followed by clot evacuation.

Niemann DB, Wills AD, Maartens NF, Kerr RS, Byrne JV, Molyneux AJ.

J Neurosurg. 2003 Nov;99(5):843-7. Comment in: J Neurosurg. 2005 Mar;102(3):582. J Neurosurg. 2005 Mar;102(3):582-3; author reply 583.

OBJECT: The aim of this study was to evaluate the efficacy of a treatment combination of coil embolization and clot evacuation in patients presenting with an intracerebral hematoma (ICH) caused by the rupture of an aneurysm. METHODS: Twenty-seven patients were prospectively recruited in this study between 1996 and 2000. Endovascular treatment of the putative ruptured aneurysm was performed as soon as practical after diagnosis and before surgical evacuation of the ICH. The Glasgow Outcome Scale (GOS) was used during follow up. Despite admission World Federation of Neurosurgical Societies grades of IV or V in 25 patients (92%), 13 (48%) recovered well with GOS scores of 1 or 2, whereas six patients (21%) died. CONCLUSIONS: The combined result of a favorable outcome in 48% of the patients and a mortality rate of 21% indicates that this treatment may be a valuable alternative for this patient group and warrants further study.

（関連文献）

Y-configured dual intracranial stent-assisted coil embolization for the treatment of wide-necked basilar tip aneurysms.
Thorell WE, Chow MM, Woo HH, Masaryk TJ, Rasmussen PA.
Neurosurgery. 2005 May;56(5):1035-40; discussion 1035-40.

Treatment of a middle cerebral artery bifurcation aneurysm using a double neuroform stent "Y" configuration and coil embolization: technical case report.
Sani S, Lopes DK.
Neurosurgery. 2005 Jul;57(1 Suppl):E209; discussion E209.