剝離は原則として全自律神経を温存してTMEを行う。これは低位前方切除術と同様の手技である。

1. 直腸間膜右側腹膜切開と中枢側郭清

まず腹腔内を系統的に観察する。頭低位で腸管を頭側右側に排除する。助手は左手鉗子，右手鉗子でS状結腸直腸間膜右側を把持し腹側に挙上し，術野を展開する。術者は峰角付近で直腸間膜右側の腹膜を切開し，上下腹神経叢を確実に背側に温存し，PRFを露出同定し，これに沿って剝離し，IMA根部へ向かう（図4a）。左側への後腹膜下筋膜の剝離はIMAを挙上できる程度とする。

助手左手鉗子はIMAの索状を把持し腹側に吊り上げる。D3では左右腰内臓神経を温存し郭清し，IMAは根部近傍で切離する。

後腹膜下筋膜の前面の層で内側より左外側へ後腹膜下筋膜の白いラインを鈍的に背側に落とすように剝離し，IMVはVSで切離する。

2. 直腸周囲剝離操作

a）直腸後面の剝離

助手は左手鉗子で直腸右側腹膜を把持，右手鉗子で郭清した直腸間膜を把持して腹側に牽引し，術野を展開する。術者は左手鉗子でカウンタートラクションをかけ，PRFに接して，まず左右下腹神経間で正中を尾側に，ついで左右に剝離を拡げる（図4b）。

b）直腸右側面の剝離

直腸右側腹膜の切開を尾側，さらに直腸前面に進め，精嚢，Denonvillier筋膜（Deno）を同定すると直腸側面の剝離ラインが想定しやすい。直腸を頭側に適度に牽引し，背側を先行し剝離を進

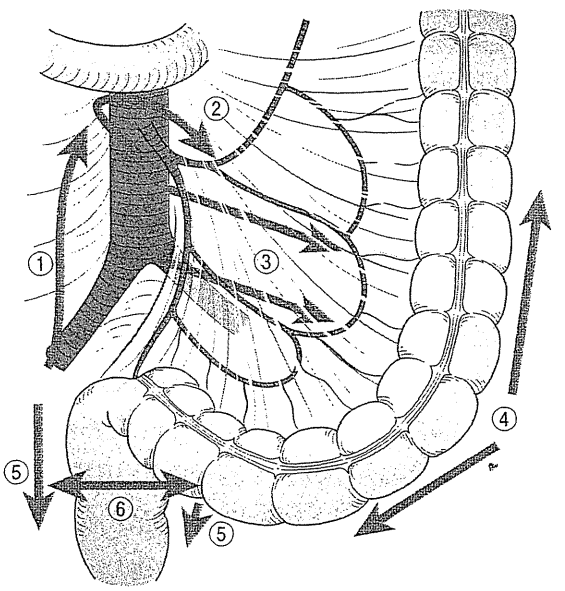

図3　腹腔鏡下低位前方切除術の手術手順

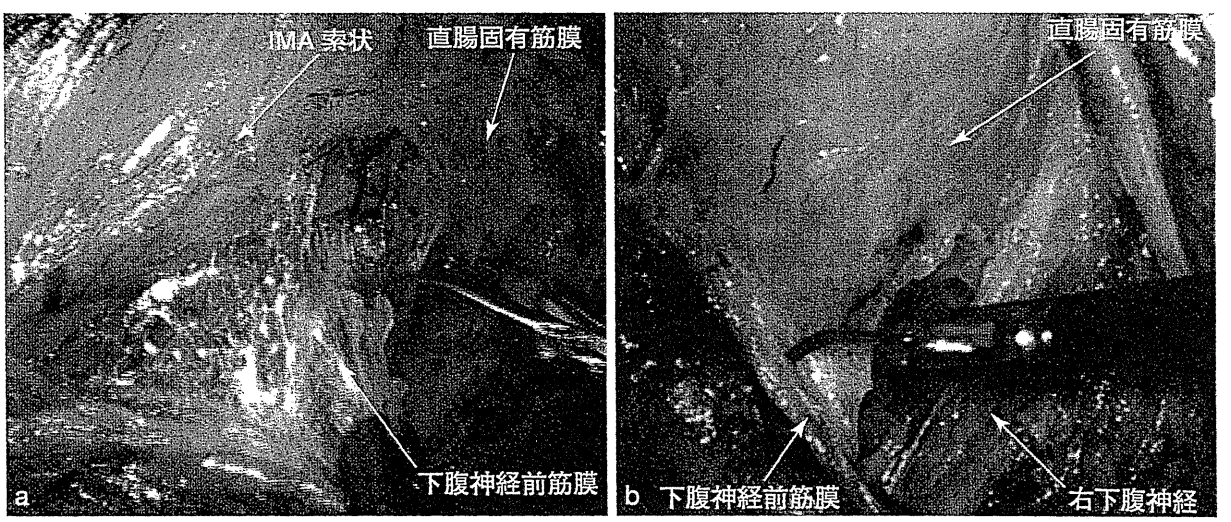

図4　直腸後面の剝離

a）直腸間膜右側の腹膜切開
腹側の光沢のある直腸固有筋膜といわゆるアワアワのもっとも直腸固有筋膜寄りを切離し，背側に上下腹神経叢を確実に温存し剝離する。
b）直腸後面の剝離
PRFの円筒状構造に接して，まず左右下腹神経の間で正中を尾側に，ついで左右に剝離を拡げる。

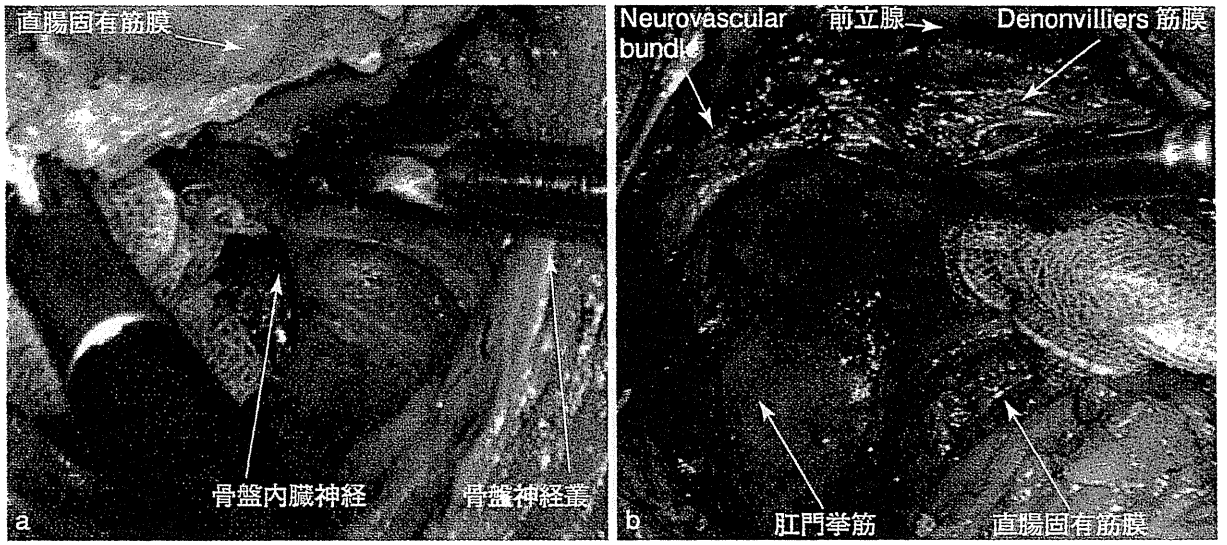

図5　直腸側面の剝離

a）直腸右側面の剝離
くの字状の頂部を順次切離し，尾側へ剝離を進めると骨盤神経叢を損傷しない。
b）直腸左前側面の剝離
直腸背側から前方に適切にカウンタートラクションを加え neurovascular bundle を丹念に剝離温存する。

める。適度なカウンタートラクションが加わると直腸との境界がくの字状に認識でき，その頂部を順次切離し，尾側へ剝離を進めると骨盤神経叢を損傷しない（図5a）。右側から PRF の円筒に沿い可及的左側まで剝離しておくとあとで行う直腸左側壁からの剝離が容易となる。

c）左外側腹膜切開

左側高位で，SD junction 付近から左外側腹膜を切開する。頭側の剝離の目安は下行結腸ほぼ中央付近までとし，通常 Miles では脾の授動は必要ない。腹膜切開を直腸左側に沿って尾側に進め直腸前面で右側からの切開とつなげる。

d）直腸左側面の剝離

助手は右手鉗子で直腸を愛護的に把持し頭側へ牽引し直線化し，左手鉗子は左側腹膜を外側に牽引する。術者は左手鉗子で直腸を内側，頭側に牽引する。左側は外側に剝離が進みやすい。さきに背側からの剝離を行い，右側と同様に PRF に沿って剝離する。

e）直腸前面・前側面の剝離

LapAPR の適応例は進行癌が多く，主に Deno を切除側に含め剝離する。助手は右手鉗子で直腸を把持し直線化し，左手鉗子をハの字に開き精嚢・前立腺を腹側に圧排する。直腸の落ち込みがなければ助手左右の鉗子で腹側に圧排する。術者の左手鉗子は内側へカウンタートラクションをかける。小ガーゼを把持し，これで直腸間膜を牽引すると滑らず，しかも間膜損傷も避けられる。背側からの剝離をさらに PRF に沿って前面に進める。あらかじめ直腸背側正中で可及的尾側まで剝離するが，ここでは PRF は急角度で腹側に向かうため，剝離が深く入りやすいので注意する。この剝離層を左右に拡げ，引きつづき肛門挙筋筋膜を同定する。直腸前側面は剝離層が密着し，剝離しにくいが，適切にカウンタートラクションを加え直腸へ向かう枝と neurovascular bundle（NVB）繊維の走行の違い（直腸枝は直腸壁に入り，NVB の繊維は前立腺外側から下部，正中に向かう。外側に進みすぎると出血する。NVB を丹念に見分けて剝離し，温存する（図5b）。直腸の2時，10時付近は NVB から直腸へ血管が入る場合が多く，確実に止血して切離する。正中で精嚢が直接見える層で剝離を尾側へ進め，これを左右に拡げる。この層をそのまま外側へ剝離を進めると NVB や骨盤神経叢を損傷する。前立腺付近で Deno は前立腺に強固に癒合し，剝離が困難となる。この手前で Deno を切開し，すぐ背側にある PRF の層に移行し，さきに左右背側から剝離し

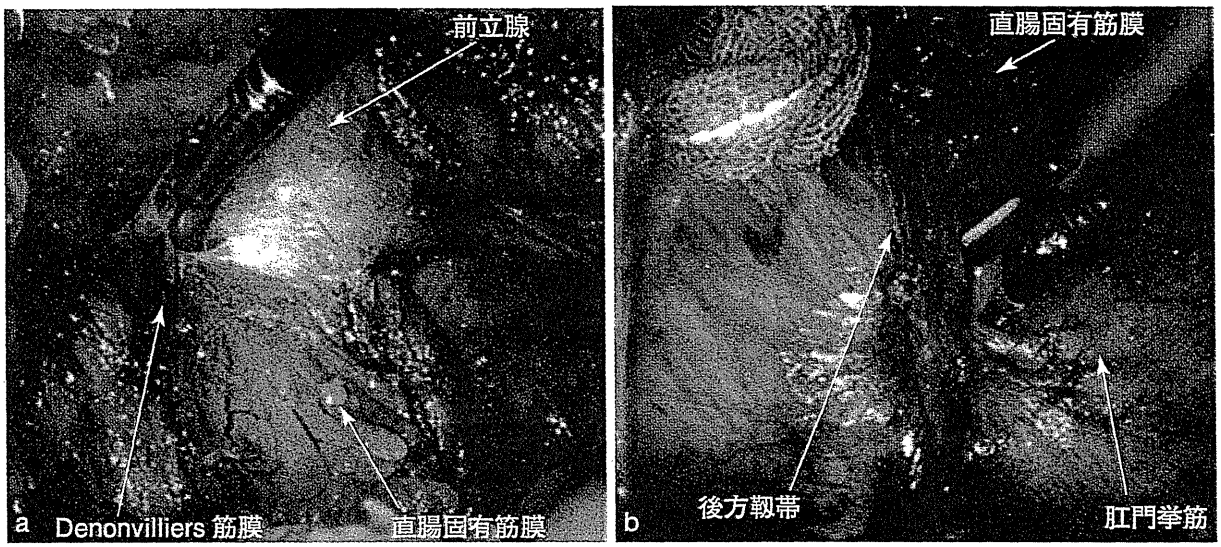

図6　直腸前面，骨盤底の剝離

a）Denonvilliers 筋膜の切開
前立腺付近で Denonvilliers 筋膜は前立腺に強固に癒合し，剝離が困難となる。この手前を切開し，すぐ背側の直腸固有筋膜の層に移行する。
b）骨盤底の剝離
骨盤底を十分剝離を進めるが，病変へ近づき過ぎることによる切り込みに十分注意し，その後の操作は会陰操作で行う。

た層と連結させる（図6a）。この層での剝離は容易で，引きつづき可及的尾側に剝離を進める。

3．骨盤底の剝離（図6b）

助手は右手鉗子をハの字に開き，低位直腸背側を腹側，頭側にやや引き出すように牽引し，左手鉗子は低位直腸右側を腹側に吊り上げ術野を展開する。術者は左手鉗子で剝離部近傍を把持しカウンタートラクションをかけ，両側から肛門挙筋を肛門管に向け剝離を進める。直腸背側正中は後方靱帯（尾骨直腸靱帯，裂孔靱帯とも言われる）で，直接切離すると直腸壁を損傷しやすい。先に直腸側面で剝離して肛門管と直腸恥骨筋との境界を同定し，これに沿い直腸後面を確認して切離する。引きつづき肛門挙筋を切り込み，座骨直腸窩の脂肪組織まで達すると会陰操作が容易となる。ただし，病変の位置に注意し，尾側へ剝離を進めて，病変に近づき過ぎることによる切り込みに十分注意し，その後の操作は会陰操作で行う。最後にLSで口側腸管の腸間膜を処理し，口側腸管切離ラインはS状結腸の長さにゆとりを持って設定し，内視鏡用自動縫合器で切離する。

4．会陰操作

砕石位，頭低位とする。肛門をあらかじめ巾着縫合で閉鎖する。皮膚切開後，座骨直腸窩の脂肪を切開し肛門挙筋に至る。左右2時，10時付近にある下直腸動脈の出血に注意する。直腸背側，尾骨との間で肛門尾骨靱帯を切離し腹腔側とつなげ，これを左右，前方に肛門挙筋を切離し，切開を拡げる。3分の2ほど切開したのち，病変を含む直腸を腹腔から体外に引き出す。直腸前壁と前立腺（膣），正中に残る直腸尿道筋との間は強固に癒合しているが，肛門側，口側から慎重に挟み込むように剝離し，直腸を抜去する。十分に止血後に閉創する。

5．側方郭清術

側方郭清を行う場合には会陰創閉鎖後に行う（図7a）。自律神経温存する場合はまず下腹神経，尿管を同定し，これを末梢に向けて十分に剝離する。273，293，283，263P，263Dの順に外側より内側に郭清する[5]（図7b）。郭清範囲は開腹手術と同様である。

腹腔内洗浄を行い，口側腸管切離断端を把持鉗子で把持し，出血，異物，腸管損傷のないことを

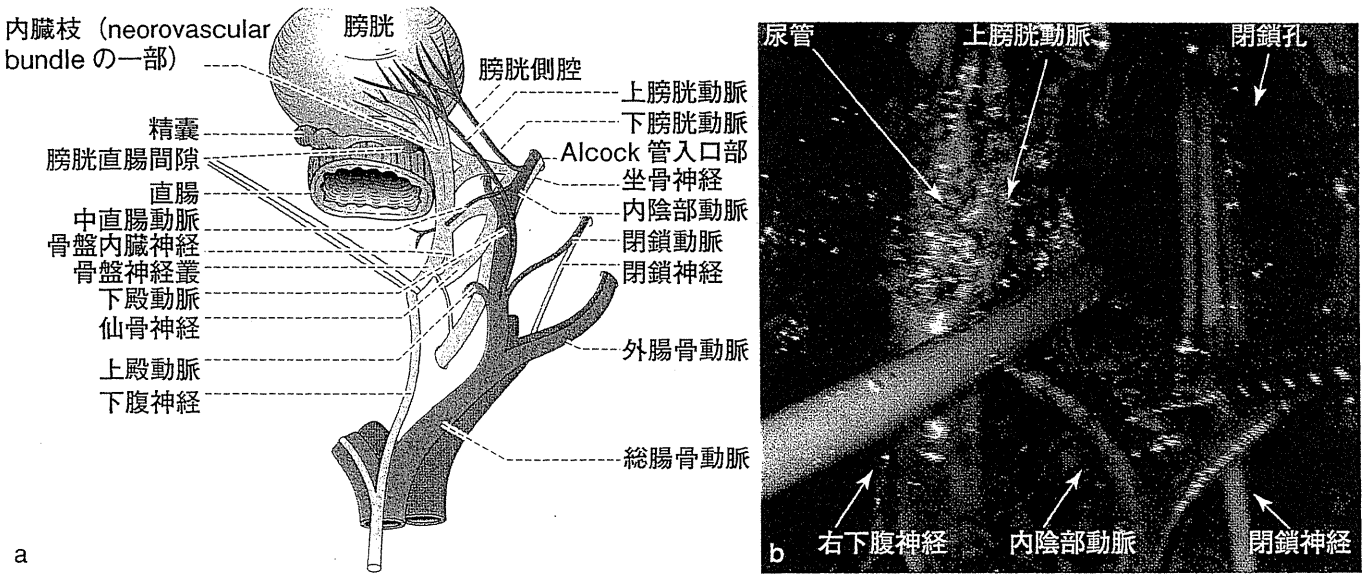

図7　側方郭清

a）腹腔鏡でみた側方郭清領域（右側）
b）神経温存側方郭清郭清終了後

十分確認し，右下ポート部からデュープルドレーンを骨盤底に挿入する。

6. 人工肛門造設

最後にマーキング部位に腹直筋経由で，人工肛門を造設する。腸管にテンション，ねじれがないように腹膜外経路はとらず，直接体外に引き出す。

おわりに

直腸癌に対する腹腔鏡下直腸切断術の安全性と根治性の向上を目指すためには術者と助手が協調して良好な術野展開を行い，わずかな出血も徹底して止血してLAPの視認性のよさ，拡大視効果を引き出し，層を見きわめて正確にTotal Mesorectal Excisionを完遂することが重要である。

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原　著

CTコロノグラフィーにおける鎮痙剤の必要性と体位変換の方向

野津　聡[1)]，西村　洋治[2)]，八岡　利昌[2)]

要　旨：【目的】CT colonography（CTC）を用手的に空気注入して行う場合の鎮痙剤使用の是非，体位変換方向の意義を検討．【対象及び方法】大腸癌術前検査目的にCTCを行った症例から対象を選び，鎮痙剤使用の是非に関しては鎮痙剤不使用9例に年齢，性別を一致させたコントロールを2例ずつ選択し，体位変換前の空気量および大腸の分割数を比較．体位変換に関しては右回り24例，左回り16例の体位変換前後の空気量の変化および体位変換後の腸管内残渣の分布を比較．【結果】鎮痙剤非使用群はコントロールに比べ大腸容積が有意に少なく，分割数も多かった．回転前後の容積変化は回転方向で差がなかったが，回転後の残渣は右回りで有意に直腸に少なく下行結腸に多かった．【結語】CTCの際に大腸を空気で拡張させる場合は1．良好な腸管拡張と連続性を保つために鎮痙剤は使用すべき．2．体位変換の方向により残渣の移動に差があり目的により変換方向を考慮すべきである．

Key words：CTコロノグラフィー，体位変換，ブスコパン，鎮痙剤，fecal tagging

はじめに

高精度，高解析のCTコロノグラフィー（以下CTC）を行うためにはワークステーションによる画像解析とその読影能力の前に適切な前処置と撮影が必須である．そこでCTCの際に鎮痙剤を使用する必要があるのか，また，体位変換にて2体位の撮像をする際の回転方向の意義について統計学的に検討した．

対　象

当院でのCTCは原則として鎮痙剤ブスコパンを検査5分前に筋注している．腸管の拡張は腹臥位でエニマシリンジを用いて用手的に空気を注入する．空気量は2リットルを目標とし患者が軽度の腹痛を訴えるまで送気しスカウト像

Antispasmodics and the direction of postural change for optimal CT colonography

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表1　鎮痙剤使用に関する case control study

鎮痙剤	性別	年齢	腹臥位容積	腹臥位分割数	仰臥位容積	仰臥位分割数	容積変化
なし	女性	48	1250	1	1040	4	210
なし	女性	62	970	10	970	7	0
なし	男性	71	1980	1	1760	1	220
なし	男性	74	970	8	970	5	0
なし	男性	77	1710	2	1820	6	110
なし	男性	78	1260	1	1260	1	0
なし	男性	78	1250	1	1310	1	60
なし	男性	80	1220	4	1300	1	80
なし	男性	82	480	12	430	22	50
あり	女性	47	1150	1	1130	1	20
あり	女性	48	2090	1	2220	1	130
あり	女性	62	1180	1	1160	3	20
あり	女性	62	1670	1	1700	4	30
あり	男性	71	1420	1	1340	3	80
あり	男性	71	1100	1	1160	3	60
あり	男性	74	2900	1	2940	2	40
あり	男性	74	1480	1	1600	2	120
あり	男性	76	2050	2	2150	2	100
あり	男性	76	2160	1	1990	2	170
あり	男性	77	1370	1	1370	3	0
あり	男性	77	1710	1	1630	1	80
あり	男性	78	2310	1	2190	1	120
あり	男性	78	2660	1	2580	1	80
あり	男性	79	1550	1	1530	1	20
あり	男性	79	1840	1	1850	1	10
あり	男性	81	1770	2	1660	2	110
あり	男性	83	1320	2	1340	6	20

（容積の単位はml）

で大腸全体の連続性を確認し，必要があれば空気を追加する．シリンジ抜去後に腹臥位像を撮像した後，仰臥位として造影CTを撮像している．体位変換の方向は2009年までは左側結腸に病変があるとの検査前情報がある患者および結腸右半切除後の患者は小腸への空気の移動を懸念して右下側臥位から左回り，その他の患者は左下側臥位からの右回りで体位を変換していたが2010年からは特に方向を指定せずに体位変換した．

対象は当センターで大腸癌術前検査としてCTCが行われた症例から抽出した．鎮痙剤使用の是非については2007年以降のCTC症例の中で既往歴に前立腺肥大または緑内障があるために鎮痙剤を使用せずにCTCを行った9症例を対象とした．また，体位変換時の回転方向の検討では2010年以降の大腸癌術前検査症例から，右回り24例，左回り16例を対象とした．

方　　法

鎮痙剤使用の是非に関しては対象9例に対しそれぞれ年齢，性別を一致させたコントロールを2例ずつ抽出し，ワークステーションにて作成したair imageから体位変換前の腹臥位の大腸容積，連続性（分割されている数）および体位変換前後の容積の変化を比較した．体位変換の方向に関しては右下側臥位から回転する左回り，左下側臥位から回転する右回りに分類し，air imageから体位変換前後の大腸全体の空気量の変化を算出，またガストログラフィンを用いたfecal tagging[1]を併用した症例の中から，前処置からCTC検査までの間に内視鏡検査にて残渣の吸引を行わなかった症例（右回り15例，左回り6例）を対象とし，volume renderingにより得た像からタギングされた各部位の残渣を抽出し分布状態を比較した．統計学的検討はMann-WhitneyのU検定により検討した．

結　　果

表1は鎮痙剤非使用者と使用者（コントロール）の大腸の容積，大腸の分割数および回転前後の容積の変化を示したものである．体位変換

表2　fecal tagging法で得た各部位の残渣量

回転前（腹臥位）残渣量						回転後（仰臥位）残渣量				
直腸	S状	下行	横行	右側	回転方向	直腸	S状	下行	横行	右側
0	1.4	8.5	103.6	74.6	右回り	1.7	0.9	35.8	53.6	50.6
13.2	34.4	25.7	157.8	60.9	右回り	30.2	1.8	91.9	109.9	46.4
0	0	1.1	25.6	71	右回り	0	0	0	34.4	55.4
2	59.4	11.7	28.8	38.9	右回り	24.7	4.2	62.4	8.9	44.1
0	0	8.2	30.5	29.7	右回り	0	0	20	14.1	37.4
7.8	85.3	28.6	95.5	41.1	右回り	13.3	6.3	159.4	7	37.8
3.7	5	19.2	64.2	73	右回り	9.1	5.7	78.5	7.4	55.8
0	21.8	24.1	109.8	100.6	右回り	0.7	12.2	131.2	39.6	81.3
8.3	58.1	17.4	117.8	59.7	右回り	1.5	10	135.9	46.2	60.4
0.8	5.7	0	59.2	24	右回り	0.7	0	14.2	50.7	28.6
0	0.5	5.3	43.7	60.2	右回り	0	1.9	22.5	17	67.7
1.1	4.7	4.2	50.1	36.9	右回り	9.4	6.7	59.1	6.3	14.2
22.3	86.6	7	222.5	86.5	右回り	24.2	69.5	10.7	34.4	254.6
8	47.3	10.4	233.6	66.1	右回り	10.9	1.4	57	226.4	119
8.5	29.8	23.9	64.9	44.3	右回り	13.3	29.4	18.5	32.5	58.2
13.8	31.9	4.1	76.2	70.4	左回り	26.3	18.4	10.7	18.1	111.5
5.9	4.7	23.3	51	0.4	左回り	10.6	10.7	18.3	54.9	30.2
1.7	57.5	34.1	136.6	83	左回り	36.3	24.7	31.8	68.9	156.4
6	289.1	11.7	177.1	85.3	左回り	126.1	177.9	36.7	67.5	175.5
24.6	28.8	30.1	75.6	5.2	左回り	43.8	4.5	24.9	10.3	77.7
12	55.9	7.7	106.3	124.7	左回り	14.3	54.2	7	95.2	122.3

（単位はml）

前の大腸容積は対象：コントロールで1232 ± 432ml: 1763 ± 515ml（p = 0.0145），大腸分割数は4.4 ± 1.5: 1.2 ± 0.2（p = 0.0167）で有意差を認めた．また，体位変換後の大腸容積は1207 ± 425ml: 1752 ± 509ml（p = 0.0101）で有意差を認めたが，大腸分割数は5.3 ± 2.2: 2.2 ± 1.3（p = 0.284）で有意差を認めなかった．体位変換前後の空気量の変化は81.1 ± 85.1ml: 67.2 ± 49.9ml（p = 0.878）で有意差は認めなかった．なお統計学的検討は行っていないが全検討患者でエニマシリンジでの空気注入中に肛門から排ガスした症例が4例あり，いずれも鎮痙剤非使用者であった．

次いで体位変換に関する検討結果である．左下側臥位を経由しての右回り：右下側臥位を経由しての左回りで比較すると体位変換前後の空気量の変化は46.2 ± 30.7ml: 60.0 ± 52.1mlで有意差は認めなかった．**表2**はfecal taggingを行った画像から得た直腸，S状結腸，下行結腸，横行結腸，右側結腸（上行結腸＋盲腸）の残渣量である．分布比率を平均した数値は回転前の腹臥位では右回りで1.9%，12.3%，6.7%，45.1%，34.0%，左回りで5.8%，21.1%，10.5%，42.3%，20.3%でいずれも横行結腸に分布が多かったが右回り，左回り2群間の残渣の分布比率には差がなかった．これに対し，回転後の分布比率は右回りで4.7%，4.4%，32.0%，22.8%，36.1%，左回りで14.6%，13.0%，9.1%，21.0%，42.3%となり直腸から下行結腸にかけての分布に有意差を認めた（直腸p = 0.0126，S状結腸p = 0.0196，下行結腸p = 0.0240）．

考　察

CTCの際の鎮痙剤使用の是非に関しては，腸管の伸展に有効とする文献[2]から，伸展にもポリープの同定にも局所的な効果しか認められずルーチンに使用すべきではない[3]とする文献まである．海外では既に炭酸ガスで腸管を伸展する方法が一般的であり，用手的な空気注入とはブスコパンの有効性が異なる可能性があるが，炭酸ガスを用いて腸管の容積と伸展していない部位の数を検討した文献でも我々の研究と同様の結果であった[4]．2011年から本邦でもCTCに対する炭酸ガス自動注入器の使用が認可されたことにより，CTCはさらに普及すると思われるが，空気注入から炭酸ガス注入に換わったとしても鎮痙剤の使用は必要と考える．

CTCの際の大腸の拡張に関しては炭酸ガス

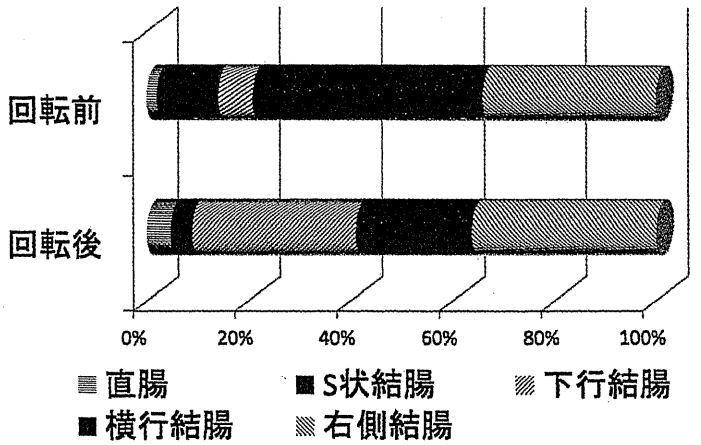

図1 左下側臥位右回転時の残渣の移動 fecal tagging15 例の平均

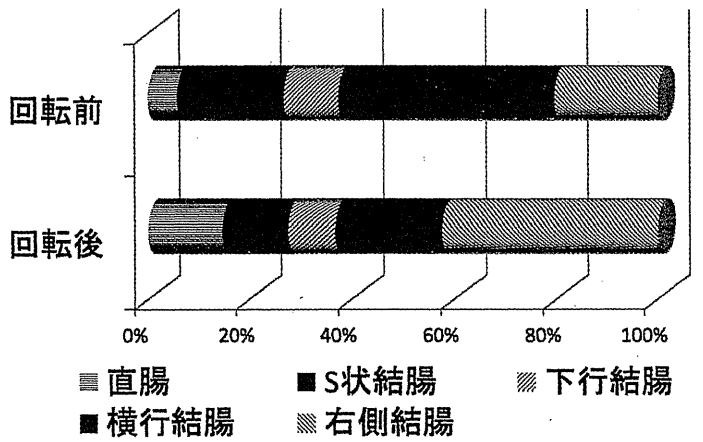

図2 右側臥位左回転時の残渣の移動 fecal tagging6 例の平均

を用いて，連続性にガスを注入する方法が一般的になれば，回盲弁からのガスの出入りを考慮する必要は無くなろう．ただし，用手的に空気を送気した今回の検討でも体位変換による大腸容積の変化に関して体位変換の方向による差は認められず，大腸が過伸展になっていなければ小腸に移動する空気量の変化に関して体位変換の方向を考慮する必要はないと考えられた．なお，CTC 前処置に腸管洗浄法（等張液法）を用いた場合は，蠕動賦活剤を用いて残液量を減らしても，完全に除去する事は不可能であり体位変換による残渣の移動の傾向は把握しておく必要がある．**図1**および**図2**は**表2**の結果から得た体位変換前後の残渣の分布の変化を右回りと左回りとで比較したものである．左下側臥位右回りで腹臥位から仰臥位になると横行結腸の残渣は下行結腸に，S 状結腸の残渣は直腸と下行結腸に移動する傾向を認めたのに対し，右下側臥位左回りで回転すると横行結腸の残渣は上行結腸に，S 状結腸の残渣は直腸に移動する傾向を認めた．このことから，下行結腸を良好に描出したい場合は右側臥位左回りで，直腸や，右側結腸を良好に描出したい場合は左側臥位右回りで回転をすべきと考える．大腸内視鏡検査で右側結腸まで到達しなかった症例に CTC を行う際には左側臥位右回りで体位変換を行い，右側結腸の残渣を少ない状態で検討すべきであろう．

結　　語

良好な CTC 画像を得るために鎮痙剤使用の是非および体位変換の方向に関して検討を行っ

た．鎮痙剤は大腸の良好な拡張および連続性を保つために使用すべきである．また，体位変換の方向による大腸小腸間の空気の移動の差は考慮の必要は無いが，残液の移動には差があり，検査目的によっては体位変換の方向の考慮が必要であると考えられた．

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Antispasmodics and the direction of postural change for optimal CT colonography

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[Aims] To clarify the following issues, whether antispasmodics should be used or not for CT colonography (CTC) using air insufflation; upon postural change from prone to supine, which rotation should be selected, clockwise or anticlockwise? [Subjects] Subjects undergoing CTC before surgery for colorectal cancer included 40 patients with antispasmodics, 24 through the left decubitus position and 16 through the right, 9 patients without antispasmodics. [Method] Each case without antispasmodics was matched to two controls for age, sex. The colon capacity and continuity were compared with the air image. As to Each case with antispasmodics and fecal tagging, the residual fluid distribution was measured with volume rendering image. [Results] The average colon capacity was 1.2 L without antispasmodics and 1.8 L in the controls ($P<0.05$). Cases without antispasmodics were separated mean 4.4 segments, but mean 1.2 segments in controls ($P<0.05$). The residual fluid after postural change was distributed 32% in the descending colon, 5% in the rectum at clockwise rotation, although 9%, 15% at anticlockwise rotation ($P<0.05$). [Conclusions] In CTC using air insufflation, antispasmodics should be used to expand the colon and reduce discontinuous segments. The direction of postural change should be performed by considering the movement of residual fluid.

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Review Article

Clinical Evidences of Laparoscopic Versus Open Surgery for Colorectal Cancer

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Laparoscopic surgery has widely spread in the treatment of colorectal cancer. In Japan, a nation-wide survey has shown that a rate of advanced colorectal cancer has increased gradually and reached 65% of the total cases for colorectal cancer in 2007. For colon cancer, many randomized controlled trials regarding short-term outcome demonstrate that laparoscopic surgery is feasible, safe and has many benefits including reduction in a peri-operative mortality. In terms of long-term outcome, four randomized controlled trials insist that there are no differences in both laparoscopic and open surgeries. However, there are still more important issues including long-term oncological outcome for advanced colon cancer, cost effectiveness and the impact on quality of life of patients. Meanwhile, for rectal cancer, a controversy persists with regard to the appropriateness of laparoscopic surgery because of concerns over the safety of the procedure and a necessity of lateral lymph node dissection for lower rectal cancer. At present, laparoscopic surgery is acceptable for Stage I colon cancer, whereas there are controversies for Stage II/III colon cancer and each staged rectal cancer because of inadequate clinical evidences. Whether laparoscopic surgery further spreads to be applied for colorectal cancer or not, it would be confirmed by Japanese large-scale phase III trial (JCOG0404) estimating oncological outcome for Stage II/III colon cancer and a Phase II trial estimating the feasibility for Stage 0/I rectal cancer in near future.

Key words: laparoscopic surgery – colorectal cancer – randomized controlled trial – multicenter study

INTRODUCTION

Recently, colorectal cancer has been a significant leading cause of death from malignancies in Japan as one of the western countries. Surgery is the mainstay of the treatment, with or without chemotherapy and/or radiotherapy. About 90–92% and 84% of patients with cancer of colon and rectum, respectively, are treated surgically (1–3). Conventional open surgery is associated with significant morbidity and long convalescence. Laparoscopic surgery has been widely used as a minimally invasive surgery to treat diverse benign diseases such as benign gall bladder disease (4,5). Jacobs et al. (6) first reported the technical feasibility of laparoscopic colectomy in 1991. Since then, laparoscopic surgery has been widely operated for various benign colorectal conditions such as polyps (7), diverticular disease (8), inflammatory bowel disease (9), rectal prolapse (5) and now colorectal cancer increasingly.

The benefits of laparoscopic surgery in comparison with open surgery have been suggested with respect to decreased morbidity, decreased pain, faster recovery, shorter hospital stay and possibly reduced immunosuppression (10–12). Laparoscopic colorectal surgery is technically complex as it involves laparoscopic mobilization of colon over a wide area, intracorporeal division of major vessels, extraction of specimen and a bowel anastomosis. There is a steep learning curve to achieve advanced laparoscopic skills, and specialized equipment is required (13). There are concerns with oncological outcome and safety of the laparoscopic procedure in colorectal cancer. There are also controversies with potential port site recurrence (14–16) after curative resection

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of tumor, hospital cost (17) and the lack of data on long-term oncological outcome.

To address these concerns, several prospective randomized clinical trials have been undertaken with longer follow-up time and larger sample size (18–22). In Japan, a retrospective multicenter study was performed to analyze the clinical outcomes for patients with colorectal cancer (23), and a prospective randomized controlled trial (Phase III) for advanced colon cancer (24) and a prospective feasible study (Phase II) for rectal cancer (25) have been conducted.

In this article, we have reviewed clinical studies of laparoscopic surgery versus open surgery for colorectal cancer. We have addressed the important problem whether laparoscopic surgery is acceptable or not for patients with colorectal cancer.

NATION-WIDE SURVEY OF LAPAROSCOPIC SURGERY FOR COLORECTAL CANCER IN JAPAN

In Japan, laparoscopic surgery for colorectal cancer was introduced in 1992. The Education Committee of Japan Society of Endoscopic Surgery (JSES) conducts a nation-wide survey every 2 years. Until the end of 2007, over 43 000 patients underwent laparoscopic colorectal surgery, and for the year 2007, ~9000 operations were carried out in Japan (26). A rate of advanced colorectal cancer has been increased gradually. Particularly, in 2007, 65% of the total cases were advanced cancer (Figure 1).

RETROSPECTIVE MULTICENTER STUDY OF LAPAROSCOPIC SURGERY FOR COLORECTAL CANCER IN JAPAN

A retrospective multicenter study of a large series of patients has been conducted to evaluate long-term results of laparoscopic surgery for colorectal cancer in Japan. The study group comprised 2036 patients undergoing laparoscopic colorectal resection during the period of April 1993–August 2002 in 12 participating surgical units (Japanese Laparoscopic Surgery Study Group). Of the 1495 patients with colon cancer, 781 (59%) had UICC Stage I, 248 (19%) had Stage II and 284 (22%) had Stage III disease. Cancer recurred in 61 (4.1%) of the 1367 curatively treated patients (median follow-up, 32 months; range 6–125 months). The 5-year survival rate was 96.7% for Stage I, 94.8% for Stage II and 79.6% for Stage III disease (Figure 2). Of the 541 patients with rectal cancer, 220 (56%) had Stage I, 62 (16%) had Stage II and 108 (28%) had Stage III disease. Cancer recurred in 30 (5.6%) of the 476 curatively treated patients (median follow-up, 25 months; range 6–102 months). The 5-year survival rate was 95.2% for Stage I, 85.2% for Stage II and 80.8% for Stage III disease. The Japanese data indicate that laparoscopic surgery for colorectal cancer yields an oncological outcome as well as that of conventional open surgery in Japanese Registry (27) for all disease stages.

CLINICAL EVIDENCES OF LAPAROSCOPIC VERSUS OPEN SURGERY FOR COLON CANCER

As searching for all published randomized controlled trials to compare laparoscopic surgery with open surgery for colon cancer, 13 studies were demonstrated in English from 1991 to 2007 (Table 1) (18,19,21,22,28–36). The rate of conversion to open surgery varied widely (0–46.4%) between those studies. There were no significant differences in overall and surgical complication rate, anastomotic leakage rate, re-operation rate and oncological clearance. However, laparoscopic surgery has a significantly lower preoperative mortality, lower wound complications, less blood loss,

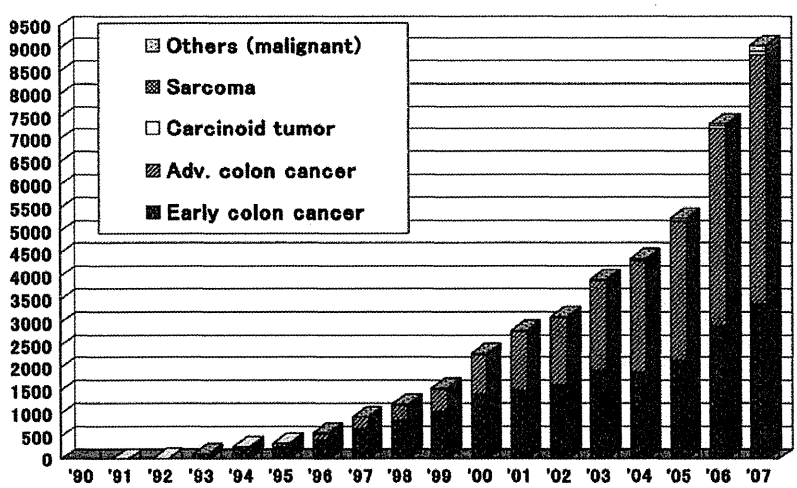

Figure 1. Current status of laparoscopic surgery for colorectal cancer in Japan. A nation-wide survey in 1373 institutes of Japan was conducted by Japan Society of Endoscopic Surgery.

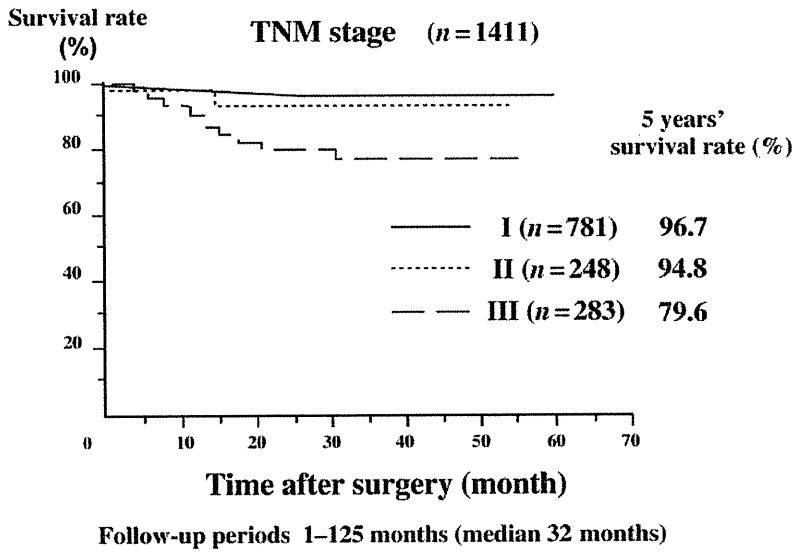

Figure 2. Long-term outcome of laparoscopic surgery for colon cancer in Japanese retrospective multicenter study. Tumor staging system is used with UICC-TNM staging.

reduced post-operative pain scores and reduced requirements for narcotic analgesia. After laparoscopic surgery, patients passed flatus earlier and had bowel movement earlier and resumed oral diet sooner than the patients did in open surgery. Prospective randomized controlled trials show that laparoscopic surgery for colon cancer is feasible, safe and has many short-term benefits.

Four randomized controlled trials have been reported to clarify long-term outcome of laparoscopic surgery for colon cancer (Table 2) (18–22). These trials were evaluated in the survival, mortality and recurrence of disease associated with two types of surgical procedures with follow-up period of 3.6–5 years. These trials reported an overall mortality rate of 17.9–32% for laparoscopic surgery and 22.2–61% for open surgery. The Clinical Outcomes of Surgical Therapy (COST) Group in USA (19,20), Leung et al. (21) and MRC CLASSICC (22) demonstrated that overall survival rate and the recurrent cancer rate were similar after laparoscopic and open surgery. Only Lacy et al. (18) described significant differences between two surgical methods. In this trial, cancer-related mortality was lower in patients with Stage III disease who underwent LCR, and no significant differences

Table 1. Randomized controlled trials comparing laparoscopic surgery with open surgery for colon cancer with regard to short-term outcome

Author or trial name (reference number)	Number of patients			Mortality rate		Morbidity rate	
	Total	Laparoscopic	Open	Laparoscopic (%)	Open (%)	Laparoscopic (%)	Open (%)
Hewitt et al. (29)	16	8	8	0	0	0	0
Milsom et al. (30)	80	42	38	1.8	1.9	15	15
Schwenk et al. (31)	60	30	30	0	0	7	27
Curet et al. (32)	43	25	18	0	0	4	17
Braga et al. (33)	183	90	93	0	0	21	38
Lacy et al. (18)	219	111	108	0.9	2.8	11	29
Hasegawa et al. (28)	50	24	26	0	0	4	19
COST (19)	810	415	395	0.5	0.9	21	20
Kaiser et al. (34)	48	28	20	0	0	18	20
Leung et al. (21)	403	203	200	0.5	2.4	20	23
CLASICC UK (22)	413	273	140	0.4	4.9	23	35
COLOR (35)	1082	536	546	1.1	1.8	21	20
Liang et al. (36)	269	135	134	0	0	15	22

Table 2. Randomized controlled trials comparing laparoscopic surgery with open surgery for colon cancer with regard to long-term outcome

Author or trial name (reference number)	Number of patients (laparoscopic versus open)	Conversion rate	Morbidity (laparoscopic versus open)	Mortality (laparoscopic versus open)	Overall survival	Disease-free survival
Lacy et al. (Spain) (18)	206 (105 versus 101)	11%	$P = 0.001$ (11% versus 29%)	$P = 0.19$ (0.9% versus 2.8%)	NS	$P = 0.006$ (Stage III subgroup)
Leung et al. (Hong Kong) (21)	403 (203 versus 200)	23%	NS (23% versus 20%)	$P = 0.97$ (2.4% versus 0.6%)	$P = 0.61$ (76% versus 73%)	$P = 0.45$ (75% versus 78%)
COST (USA) (20)	863 (435 versus 428)	21%	$P = 0.64$ (21% versus 20%)	$P = 0.40$ (0.5% versus 0.9%)	$P = 0.51$ (86% versus 85%)	NS
CLASICC (UK) (22)	794 (526 versus 268)	16%	NS (35% versus 33%)	$P = 0.65$ (0.4% versus 4.9%)	$P = 0.35$ (67% versus 68%)	$P = 0.70$ (66% versus 68%)

NS, not significant differences.

were found with respect to patients with Stage I and II disease. Reza et al. (37) reported that meta-analysis of four randomized controlled trials had not revealed any significant difference in terms of cancer-related mortality and recurrence rates between laparoscopic and open surgery. Transatlantic laparoscopically assisted versus open-colectomy trials study group also reported that meta-analysis demonstrated no significant difference in terms of long-term survival between both surgical procedures (38). Prospective randomized controlled trials and meta-analysis in terms of long-term outcome states that there are no differences in the two surgical procedures. However, these randomized controlled trials in western countries also have several problems such as the criteria including early staged cancer and benign disease, undetermined level of lymph node dissection, unclear indication for adjuvant chemoradiotherapy and no description of quality control of the two surgical procedures.

CLINICAL EVIDENCES OF LAPAROSCOPIC VERSUS OPEN SURGERY FOR RECTAL CANCER

The results of multicenter randomized controlled trial to evaluate laparoscopic versus open surgery for rectal cancer have seldom been reported either in Japan or any other foreign countries, yet there is a report to present the fact that there is no significant difference between laparoscopic and open surgery in oncological short-term prognosis (22). There are not many reports regarding prognosis of laparoscopic surgery for advanced rectal cancer. However, there are some reports that an incidence of complications such as anastomotic leakage and pelvic abscess in laparoscopic surgery is the same as, or higher than that in open surgery (39–42). In 2007, CLASICC trial group targeted 794 patients with colon and rectal cancer in multicenter randomized clinical trial of laparoscopic versus open surgery (22). There was no significant difference in 3-years' local recurrence and overall survival rates after curative resection between both the groups. Though there was 5% in mortality rate in each group, a positive rate of circumferential resection margin in laparoscopic group was higher than that in open group. Short-term results of laparoscopic surgery for rectal cancer were shown in Table 3 (43–47). In retrospective studies, tumors were located at 0–15 cm away from the anal verge, and a conversion rate to open surgery was 3–12%. A rate of post-operative complications was 21–36%, and a rate of anastomotic leakage was 5.8–17.3%. In these reports from western countries, pre- or post-operative chemoradiotherapy was treated for 40% of patients with T3 or deeper rectal cancer. Because a standard treatment for advanced rectal cancer is different from the one in Japan, further detailed study would surely be required about the adaptation of laparoscopic surgery.

Table 3. Retrospective studies of laparoscopic surgery for rectal cancer with regard to short-term outcome

Author (reference number)	Number of patients	Conversion rate (%)	Leakage (%)	Complication (%)
Morino et al. 2003 (43)	100	12	17	36
Leroy et al. 2004 (45)	102	3	17	27
Zhou et al. (44)	82	NE	1	6
Dulucq et al. 2005 (46)	218	12	11	26
Kim et al. 2006 (47)	312	3	6	21

NE, not evaluated.

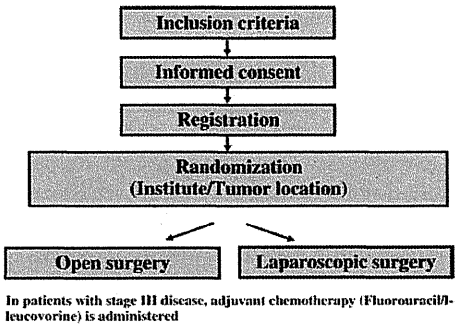

Figure 3. A protocol design of Japanese multicenter randomized controlled trial (Japan Clinical Oncology Group 0404) to compare laparoscopic surgery with open surgery to evaluate oncological outcome for advanced colon cancer.

A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL FOR COLON CANCER IN JAPAN

In Japan, we have conducted a randomized controlled trial to compare laparoscopic surgery with open surgery to evaluate oncological outcome for advanced colon and recto-sigmoid cancer (24). This study has been supported in part by a Grant-in-Aid for Cancer Research from the Japanese Ministry of Health, Labor and Welfare. The Clinical Trial Review Committee of the Japan Clinical Oncology Group (JCOG) approved the protocol in September 2004, and the study (JCOG0404) has started in November 2004 to elucidate the optimal treatment for T3 or deeper colorectal cancer. Surgeons at 27 specialized institutions will recruit 1050 patients. The primary endpoint is the overall survival rate. Secondary endpoints are relapse-free survival rate, short-term clinical outcomes, adverse events and a rate of conversion from laparoscopic surgery to open surgery. The short-term clinical outcomes are the proportion of the use of analgesics, the duration from operation to flatus, the highest body temperature during hospitalization and the highest body temperature during 3 days after operation. In both arms, resection of colon or rectum with D3 lymphadenectomy is performed according to the Japanese Classification of Colorectal Carcinoma (48). The patients are randomized by the minimization method of balancing the groups according to the location of the tumor and the institution (Figure 3). This Japanese randomized controlled trial has characteristic designs comparing with other western trials such as inclusion criteria of only advanced cancer (T3, T4), lymph node dissection, adjuvant chemotherapy and the quality control. In the case of pathological Stage III colorectal carcinoma, three cycles of adjuvant chemotherapy with fluorouracil and L-leucovorin are administered. To control the quality of operation, central review of surgical procedure was done by using photographs of all patients. A registration of the patients in this trial will be accomplished in March 2009.

A PROSPECTIVE STUDY FOR RECTAL CANCER IN JAPAN

To examine technical and oncological feasibility of laparoscopic surgery for rectal cancer, a Phase II trial (Lap-RC) started to be applied to patients with a preoperative diagnosis of Stage 0/I rectal cancer under the direction of the Japan Society of Laparoscopic Colorectal Surgery (26). Surgeons at 39 specialized institutions will recruit 350 patients. The primary endpoint at the first stage is an anastomotic leakage rate by double-stapling technique and the one at the second stage is an overall survival rate. Secondary endpoints are relapse-free survival rate, short-term clinical outcome, adverse events, the rate of histologically curative operation, the proportion of completion of laparoscopic and the conversion rate. To control the quality of operation, central review of surgical procedure was done by using photographs of all patients.

CONCLUSIONS AND PERSPECTIVES

Laparoscopic surgery has widely spread as a less invasive procedure for colorectal cancer in Japan and western countries. A nation-wide survey by JSES revealed that a rate of advanced colorectal cancer has increased gradually and reached two-thirds of total cases in 2007. Many randomized controlled trials demonstrate that laparoscopic surgery for colon cancer is feasible, safe and has many short-term benefits including reduction in peri-operative mortality. There are still more important issues including long-term oncological outcome for advanced colon cancer, cost-effectiveness and the impact on quality of life of patients with colon cancer. Meanwhile, a controversy persists with regard to the appropriateness of laparoscopic surgery for patients with rectal cancer because of concerns over the safety of the procedure, especially in low anterior resections for lower rectal carcinoma. Additionally, lateral lymph node dissection combined with total mesorectal excision remains the standard surgical procedure for patients with advanced

lower rectal carcinoma in Japan, but lateral lymph node dissection by laparoscopic surgery is still an unexplored frontier (49–51). At present, laparoscopic surgery is acceptable for Stage I disease of colon cancer, also it is generally not acceptable for Stage II/III colon cancer and each staged rectal cancer. However, experienced and trained surgeons may do laparoscopic surgery for Stage II/III colon cancer and early staged rectal cancer with accepting the informed consent from patients because clinical outcomes of laparoscopic surgery are equivalent or superior to open surgery in previous clinical trial reports. Further works are needed to estimate laparoscopic procedures for advancer colon and rectal cancer. Japanese on-going large-scale RCT (JCOG0404) estimating oncological outcome for Stage II/III colon cancer (24) and a prospective feasible study for Stage 0/I rectal cancer (25) would be beneficial to determine the role of laparoscopic surgery as a standard operation for colorectal cancer. General surgeons expect the report of clinical results of Japanese two trials to come out as soon as possible.

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Conflict of interest statement

None declared.

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Laparoscopic Surgery for Transverse and Descending Colon Carcinomas Has Comparable Safety to Laparoscopic Surgery for Colon Carcinomas at Other Sites

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Key Words
Transverse colon carcinoma · Descending colon carcinoma · Colon carcinoma

Abstract
Background/Aims: Many randomized clinical trials have been performed to treat colon carcinoma with the exclusion of transverse colon carcinoma or descending colon carcinoma. The aim of the present study was to investigate the difference in surgical outcomes between laparoscopic surgery for transverse/descending colon carcinomas and that for other colon carcinomas. ***Methods:*** A total prospective registry of 455 patients with colon carcinoma, who initially underwent laparoscopic surgery between June 2001 and December 2008, were reviewed. Surgical outcomes were compared between laparoscopic surgery for transverse/descending colon carcinoma (transverse/descending group, n = 89) and laparoscopic surgery for other colon carcinomas (other group, n = 366). ***Results:*** There was no perioperative mortality. Preoperative clinical characteristics were similar between the two groups. Regarding operative and postoperative results, the surgical duration and intraoperative blood loss were significantly greater in the transverse/descending group. However, there were no significant differences in the postoperative course between groups, and the complication rates between the groups were similar. ***Conclusion:*** Laparoscopic surgery for transverse/descending carcinoma can be performed safely, and shows short-term benefits comparable to those in patients who underwent laparoscopic surgery for other colon carcinomas.

Introduction

The application of laparoscopic surgery has gradually increased since the first report of laparoscopic surgery for colon carcinoma in 1991 [1]. Long-term oncological safety is an important concern following laparoscopic surgery for malignancies, and in this respect laparoscopic surgery is at least equivalent to conventional open surgery based on randomized clinical trials; however, many of these trials have been performed to treat colon carcinoma with the exclusion of transverse colon carcinoma or transverse colon and descending colon carcinoma, which require relatively advanced surgical skills [2–8]. In Japan, patients with transverse colon or descending colon cancer were excluded from the randomized control trial (JCOG 0404), and we believe that evaluation of the surgical outcomes of laparoscopic surgery for these patients is necessary. These exclusions have been made because of

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safety concerns, i.e. the risk of complications associated with the laparoscopic procedure.

Several recent prospective case series studies of laparoscopic surgery for transverse colon carcinoma have demonstrated the safety of the procedure [9, 10]. In Japan, a prospective randomized clinical trial comparing surgical and oncological outcomes between laparoscopic surgery and open surgery is currently underway in patients with clinical T3 or T4 colon and rectosigmoid carcinoma; however, patients with transverse colon and descending colon carcinoma have been excluded from this Japanese trial for technical reasons [8]. Therefore, the current study was designed to compare surgical outcomes between laparoscopic surgery for transverse colon and descending colon carcinomas and that for other colon carcinomas, in the absence of randomized clinical trials comparing laparoscopic and open surgery for transverse colon and descending colon carcinoma.

Material and Methods

The study took the form of a single-center, prospective, observational, case-series analysis. Between July 2001 and December 2008, we performed 455 continuous laparoscopic colectomies for selected patients with colon carcinoma. Because the safety of laparoscopic surgery in cancer patients remains to be established, candidates for a radical surgery were basically patients who were preoperatively diagnosed with T1 or T2. Laparoscopic surgery was also performed in patients who were preoperatively diagnosed with T3/4 but wished to undergo laparoscopic surgery as well as in those for which palliative resection was considered necessary. Additionally, patients allocated to laparoscopic surgery in a randomized controlled trial, which compared the surgical results of laparoscopic surgery to open surgery in patients with advanced colorectal carcinoma, underwent laparoscopic surgery [8]. We excluded the following groups of patients from laparoscopic resection: patients with tumors larger than 8 cm, patients with a prior history of extensive adhesions, patients with severe obesity (BMI >35), patients with intestinal obstruction, and patients who did not consent to laparoscopic surgery. During the study period, we experienced 2 patients who underwent two simultaneous laparoscopic colectomies for synchronous double colon carcinomas, and these 2 patients were excluded from the study.

Surgical outcomes were compared between laparoscopic surgery for transverse colon and descending colon carcinoma (transverse/descending group, n = 89) and laparoscopic surgery for other colon carcinomas (other group, n = 366).

All patients were evaluated before operation by clinical investigation, including barium enema or computed tomographic colonography, total colonoscopy, chest X-ray, abdominal ultrasonography and computed tomography. We defined conversion to open surgery as any incision greater than 8 cm, excluding cases in which the incision was enlarged due to a large specimen size that could not be removed from an 8-cm incision.

Regarding a postoperative follow-up, patients with stage I tumors were examined by chest and abdominopelvic CT, as well as carcinoembryonic antigen measurement every year for at least 5 years. Patients with stage II tumors were examined every 6 months for 3 years, then yearly for at least 2 years. Patients with stage III tumors were examined every 4 months for 2 years, then every 6 months for at least 3 years. Postoperatively, patients with stage III received adjuvant chemotherapy with 5-fluorouracil plus leucovorin or uracil-tegafur plus leucovorin.

Our institutional review board does not mandate obtaining their approval for the collection of patient clinical records prospectively and for publication as an institutional case-series study, and written consent was obtained from all patients for the use of their clinical data in the future.

The techniques of laparoscopic resections have been thoroughly described previously [11, 12].

For right-sided lesions, the right colon was mobilized initially, and the vascular pedicles were divided at their origin together with draining lymph nodes intracorporeally. From 2004, the laparoscopic no-touch isolation technique, so-called 'median-to-lateral' approach, was performed. In this technique, after early proximal ligation of the tumor-feeding vessels and mobilization of the right colon from median-to-lateral direction, mobilization was completed by cutting the peritoneum from the lateral side. The bowel loop was then delivered under a wound protector through a small incision. The division of the marginal vessels and anastomosis were performed extracorporeally.

For transverse colon lesions, at least, mobilization of the hepatic flexure or splenic flexure or both flexures was performed according to the tumor location. Mobilization of both flexures was performed without hesitation to avoid tension on the anastomosis. Proximal ligations of the right or left branch or the root of middle colic vessels at their origins were usually, but not always, performed intracorporeally. Usually, right hemicolectomy was performed for tumors located from the hepatic flexure to one-third on the right side of transverse colon. Regarding middle colic vessel ligation for right hemicolectomy, the root of the right branch of the middle colic artery or origin of the middle colic artery was confirmed and clipped after proximal ligation of ileocolic and right colic vessels by the median-to-lateral approach. Usually, the middle colic vein is clipped just before it is drained into the gastrocolic trunk. For tumors located from the splenic flexure to one-third on the left side of transverse colon, partial resection of transverse colon and descending colon was performed. In this procedure, the root of the left branch of middle colic vessels is skeletonized in a caudal to cranial direction, and clipped. For mid-transverse tumors, partial resection or transverse colectomy was performed. A transverse colectomy was defined as a procedure with mobilization of both the hepatic and splenic flexure together with ligation of the middle colic vessels at their origin. In this procedure, the middle colic artery is skeletonized in a caudal to cranial direction, and clipped at the origin, or both branches of the middle colic artery are clipped at or near their roots. Similarly, the middle colic vein is clipped just before it is drained into the gastro-colic trunk, or at the same level of both branches of the middle colic artery. Sometimes, endolinear staplers are used for the division of right or left branches of middle colic vessels.

For descending colon and proximal sigmoid colon lesions in which extracorporeal anastomosis was considered possible, the

left colon was mobilized initially. After mobilization of the splenic flexure, intracorporeal ligation of the tumor-feeding vessels (left colic artery, sigmoid arteries, inferior mesenteric vein) at their origins was performed, and the bowel loop was delivered through a small incision and the mesenterium was divided extracorporeally followed by extracorporeal anastomosis.

For distal sigmoid colon lesions, after mobilization of the left colon and splenic flexure if necessary, intracorporeal high ligation of the inferior mesenteric vessels followed by mobilization of the rectum and excision of the mesorectum were performed. From 2004, the median-to-lateral approach was also employed. In this technique, after early proximal ligation of the tumor-feeding vessels (inferior mesenteric artery or superior rectal artery, and inferior mesenteric vein), mobilization of the left colon was performed from the median-to-lateral direction. After the completion of full mobilization by cutting the peritoneum from the lateral side, the bowel loop was delivered through a 4- to 8-cm incision made over the mid-lower port site under wound protection and the mesenterium was divided extracorporeally followed by extracorporeal anastomosis. For patients with sigmoid colon carcinoma located near the rectosigmoid junction, mobilization of the rectum and excision of the mesorectum were performed intracorporeally by laparoscopic surgery. A 4- to 6-cm incision was then made over the mid-lower port site, and the bowel was exteriorized under wound protection. Regarding the distal margin, mesorectal tissue down to at least 5 cm below the tumor was excised routinely. Anastomosis was performed by the double-stapling technique.

In all cases, the retroperitoneum was not repaired.

The parameters analyzed included gender, age, body mass index, prior abdominal surgery, ASA classification, simultaneous procedures, operative time, operative blood loss, conversion rate, days to resume diet, length of postoperative hospital stay, and postoperative complications within 30 days of operation. Pathological staging was performed according to the TNM classification [13].

Data on combined surgical techniques were all included in the analyses of colon carcinoma surgeries.

Statistical analysis was performed using the Mann-Whitney U test, the Fisher's exact test, and the χ^2 test as appropriate. $p < 0.05$ was considered significant.

Results

Patient demographics are summarized in table 1. No significant differences were observed in baseline characteristics between the two groups. With regard to combined surgical techniques, 5 patients in the transverse/descending group and 12 patients in the other group underwent combined surgery ($p = 0.3458$).

Operative and postoperative results are shown in table 2. All operations in the other group were completed laparoscopically in this series; however, 1 patient (1/89, 1.1%) in the transverse/descending group with transverse colon carcinoma required conversion to conventional open surgery because of tumor invasion to the duodenum. The surgical duration and intraoperative blood loss were significantly longer in the transverse/descending group; however, liquid and solid food was started on median postoperative days 1 and 3 in both groups. Similarly, the median length of postoperative hospitalization was 8 days in both groups. No significant differences were observed in the postoperative course between the two groups. All patients were discharged to home.

Postoperative complications within 30 days after initial operation are listed in table 3. There were no perioperative mortalities. The morbidity rate was 14.6% (13/89) in the transverse/descending group, and 10.9% (40/366) in the other group ($p = 0.3571$). In the transverse/descending group, one patient required readmission 23 days after initial operation because of duodenal ulcer perforation, which could be treated conservatively. In the other group, anastomotic leakage occurred in 1 patient, and emergency operation was required. Reoperation of laparoscopic division of an adhesive band for a postoperative small bowel obstruction was necessary in another patient. For 2 patients with anastomotic bleeding after double-stapling technique anastomosis, endoscopic clippings were performed successfully.

Discussion

In the present study, short-term outcomes after laparoscopic surgery were compared between the transverse/descending group and other group. The operative time was significantly longer and the intraoperative blood loss was significantly greater in the transverse/descending group, but the complication rates and postoperative courses of the two groups were similar and there was no anastomotic leakage in the transverse/descending group. The observed safety of laparoscopic surgery for patients with transverse colon and descending colon carcinoma may be due to improved instruments and the proficiency of surgeons.

The design of the present study was limited in that laparoscopic surgery was not compared with open surgery, the patients were in relatively early stages, and the long-term prognosis was unknown in many cases. In the previous randomized clinical trials s comparing surgical outcomes between laparoscopic surgery and open surgery, patients with transverse colon and descending colon carcinoma have been excluded [2–8]. It goes without saying that prospective randomized clinical trial is ideal to demonstrate that short-term and oncological outcomes

Table 1. Characteristics of 455 colon carcinoma patients who underwent laparoscopic resection

	Transverse/ descending group (n = 89)	Other group (n = 366)	p value
Gender (male/female)	55/34	204/162	0.3402
Age, years (mean, range)	61.4 (22–83)	62.7 (22–88)	0.3479
BMI (mean, range)	23.1 (16.8–32.3)	22.8 (14.0–34.6)	0.6004
Prior abdominal surgery, %	23 (25.8)	101 (27.6)	0.7918
ASA classification, %			0.3618[a]
ASA I	52 (58)	214 (58)	
ASA II	24 (27)	116 (32)	
ASA III	13 (15)	36 (10)	
TNM classification, %			0.3875[b]
I	58 (65)	211 (58)	
II	9 (10)	54 (15)	
III	19 (21)	77 (21)	
IV	3 (3)	24 (7)	
Location, %			
Vermiform appendix	0	2 (1)	
Cecum	0	57 (16)	
Ascending colon	0	88 (24)	
Transverse colon	55 (62)	0	
Descending colon	34 (38)	0	
Sigmoid colon	0	219 (60)	
Laparoscopic colorectal procedures, %			
Ileocecal resection	0	61 (17)	
Right hemicolectomy	24 (27)	86 (23)	
Transverse colectomy	3 (3)	0	
Left hemicolectomy	4 (4)	0	
Descending colectomy	22 (25)	0	
Sigmoid colectomy	0	200 (55)	
Partial resection	36 (40)	19 (5)	
Combined surgical techniques, n			0.3458
Cholecystectomy	1	3	
Umbilical hernia repair	1	0	
Nephroureterectomy	1	0	
Hemilateral neck lymph node dissection	1	0	
Total laryngectomy	1	0	
Pulmonary resection	0	2	
Unilateral salpingo-oophorectomy	0	2	
Partial mastectomy	0	1	
Wedge resection of gastric submucosal tumor	0	1	
Resection of submandibular gland tumor	0	1	
Resection of ileum tumor	0	1	
Inguinal hernia repair	0	1	

χ^2 value: [a] 2.0331, [b] 3.0268.

of laparoscopic surgery are not inferior to those of open surgery in patients with transverse colon and descending colon carcinoma; however, the incidence of transverse colon and descending colon carcinoma is low among colon carcinomas, which makes it difficult to conduct randomized clinical trial with an endpoint of long-term outcome due to the lack of a sufficient number of patients. In these circumstances, the outcome of laparoscopic surgery for transverse colon and descending colon carcinoma was compared with that for laparoscopic surgery for other colon carcinomas in the present study to show the efficacy of laparoscopic surgery in selected patients. Con-