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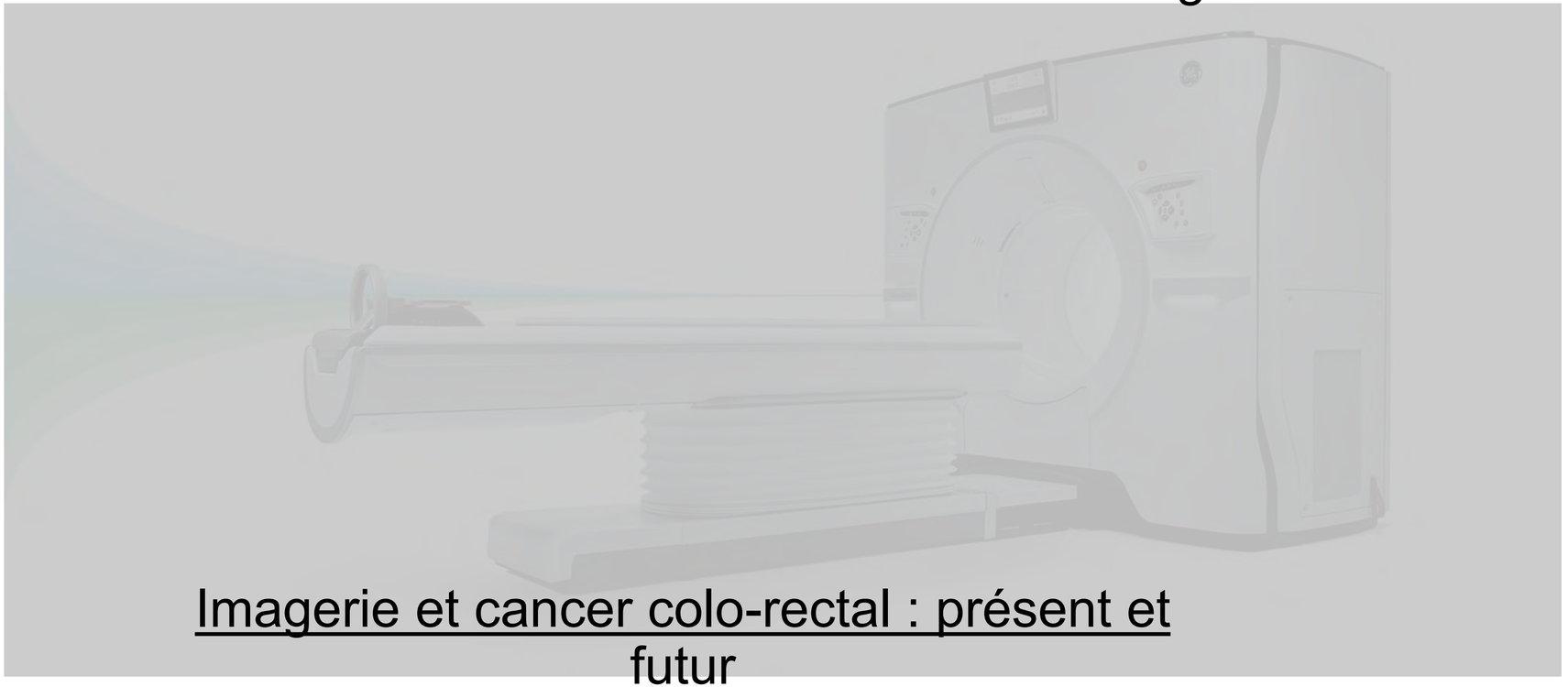
Jeudi de formation continue de médecine interne générale



Imagerie et cancer colo-rectal : présent et futur

Dr Constantin Christophe Service de radiologie
Hôpital du Valais

Jeudi 6 avril 2023

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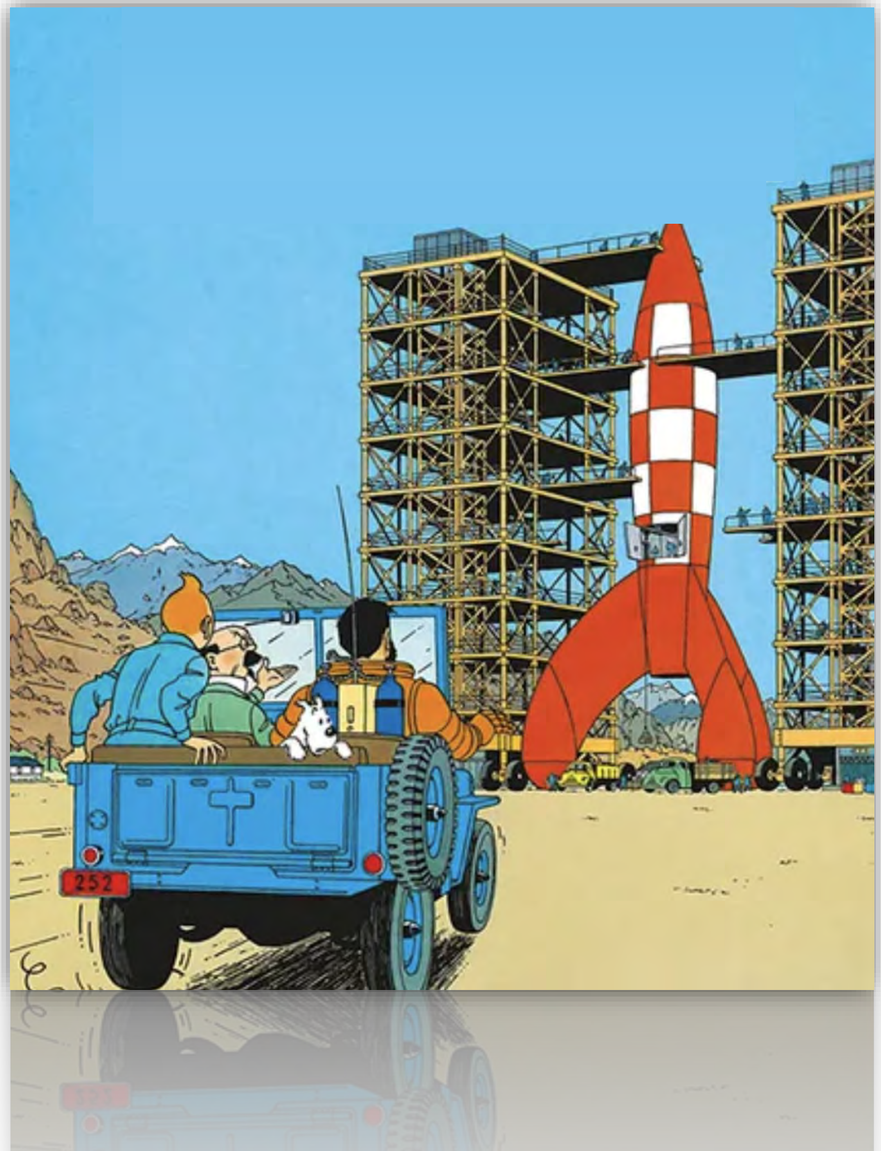
Objectifs

- Diagnostique
- Staging
- Traitement radiologique
- Apport de l’IA



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Diagnostique

- <u>Dépistage</u>
  - Coloscopie optique
  - Coloscopie virtuelle (dépistage, coloscopie incomplète)
  - Détection sang dans les selles

- <u>Découverte fortuite</u>
  - Scanner de débrouillage (douleurs abdominales, perte de poids,..)
  - Scanner en urgence (occlusion, hémorragie)
  - « incidentalome » lors d'imagerie

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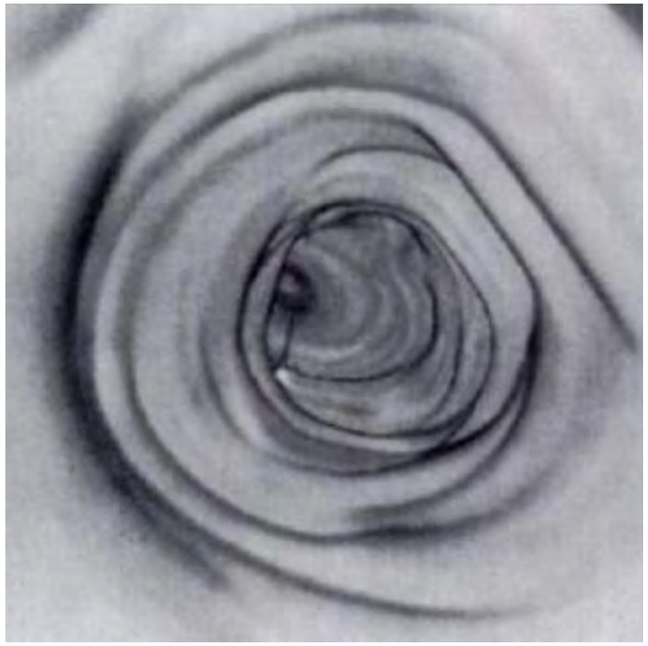
Diagnostique

1997



1 x 5 mm

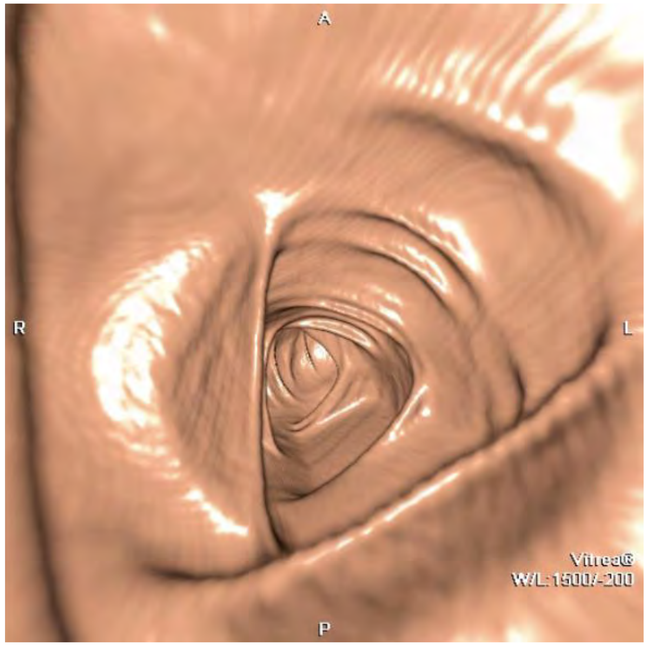
50

2002

16 x 0.75 mm

15

2007



64 x 0.6 mm

8

Aujourd'hui : 320 x 0.5 mm 1sec

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Diagnostique

Eur Radiol (2011) 21:1747–1763
DOI 10.1007/s00330-011-2104-8

GASTROINTESTINAL

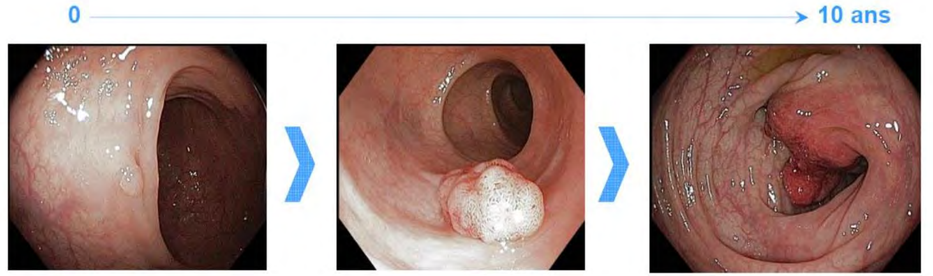
Diagnostic value of CT-colonography as compared to colonoscopy in an asymptomatic screening population: a meta-analysis

Margriet C. de Haan · Rogier E. van Gelder · Anno Graser · Shandra Bipat · Jaap Stoker

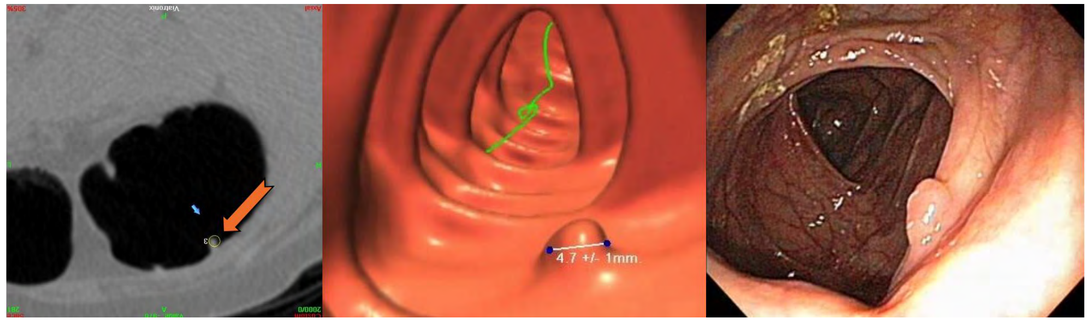
Received: 14 November 2010 / Revised: 1 February 2011 / Accepted: 3 February 2011 / Published online: 1 April 2011

Abstract
Objectives Previous meta-analyses on CT-colonography included both average and high risk individuals, which may overestimate the diagnostic value in screening. A meta-analysis was performed to obtain the value of CT-colonography for screening.
Methods A search was performed using PubMed, Embase and Cochrane. Article selection and critical appraisal was done by two reviewers. Inclusion criteria: prospective, randomized trials or cohort studies comparing CT-colonography with colonoscopy (≥50 participants), ≥95% average risk participants ≥50 years. Study characteristics and 2×2 contingency Tables were recorded. Sensitivity and specificity estimates were calculated per patient and per polyp (≥6 mm, ≥10 mm), using univariate and bivariate analyses.
Results Five of 1,021 studies identified were included, including 4,086 participants (<1% high risk). I^2-values showed substantial heterogeneity, especially for 6–9 mm polyps and adenomas: 68.1% vs. 78.6% (sensitivity per patient). Estimated sensitivities for patients with polyps or adenomas ≥6 mm were 75.9% and 82.9%, corresponding specificities 94.6% and 91.4%. Estimated sensitivities for patients with polyps or adenomas ≥10 mm were 83.3% and 87.9%, corresponding specificities 98.7% and 97.6%. Estimated sensitivities per polyp for advanced adenomas ≥6 mm and ≥10 mm were 83.9% and 83.8%.
Conclusion Compared to colonoscopy, CT-colonography has a high sensitivity for adenomas ≥10 mm. For (advanced) adenomas ≥6 mm sensitivity is somewhat lower.

Keywords Colorectal cancer · Screening · CT-Colonography · Colonoscopy · Sensitivity and specificity



Taille	<1cm	1-2cm	>2cm
Malignité	0.3%	9%	28%



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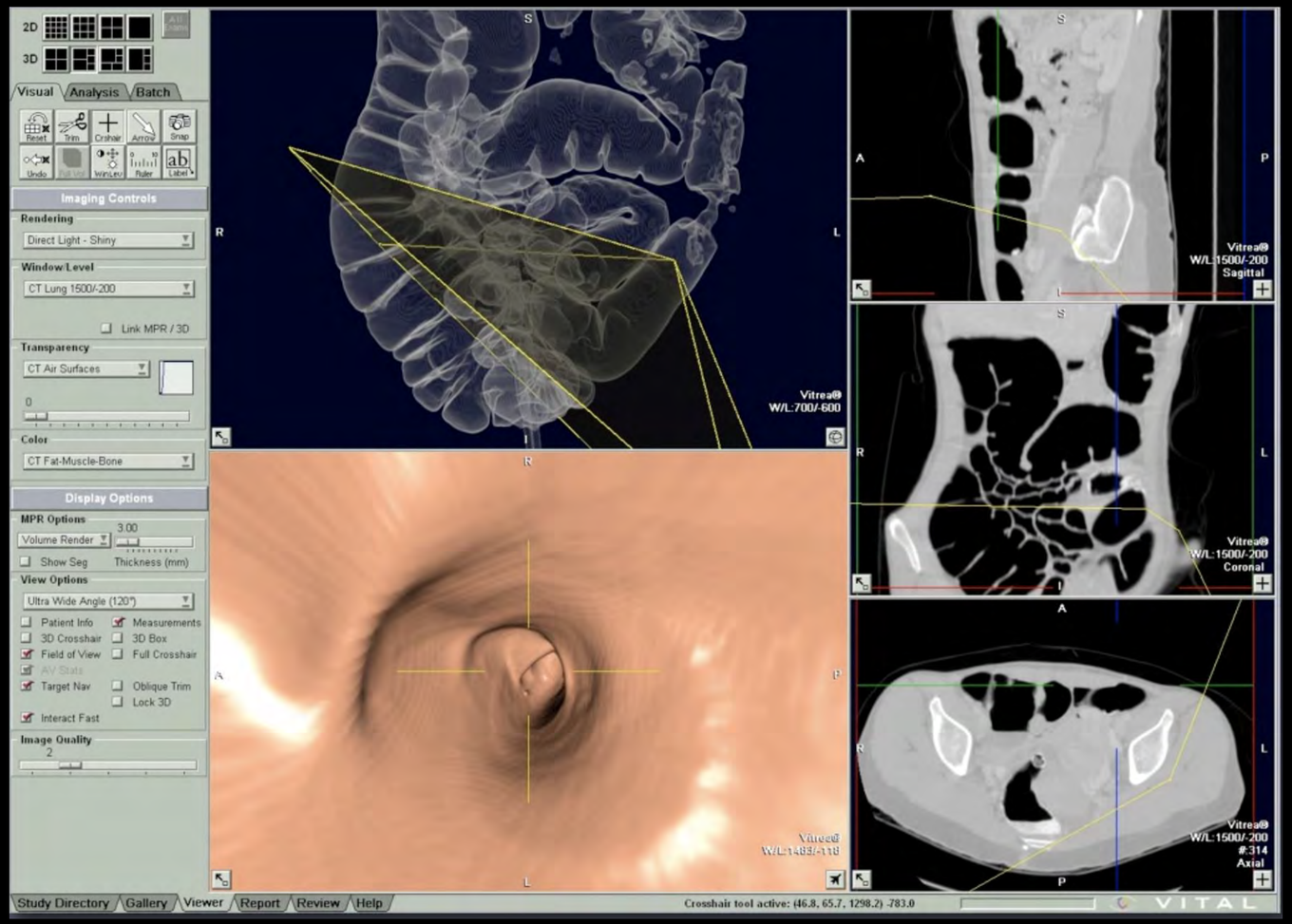
Diagnostique



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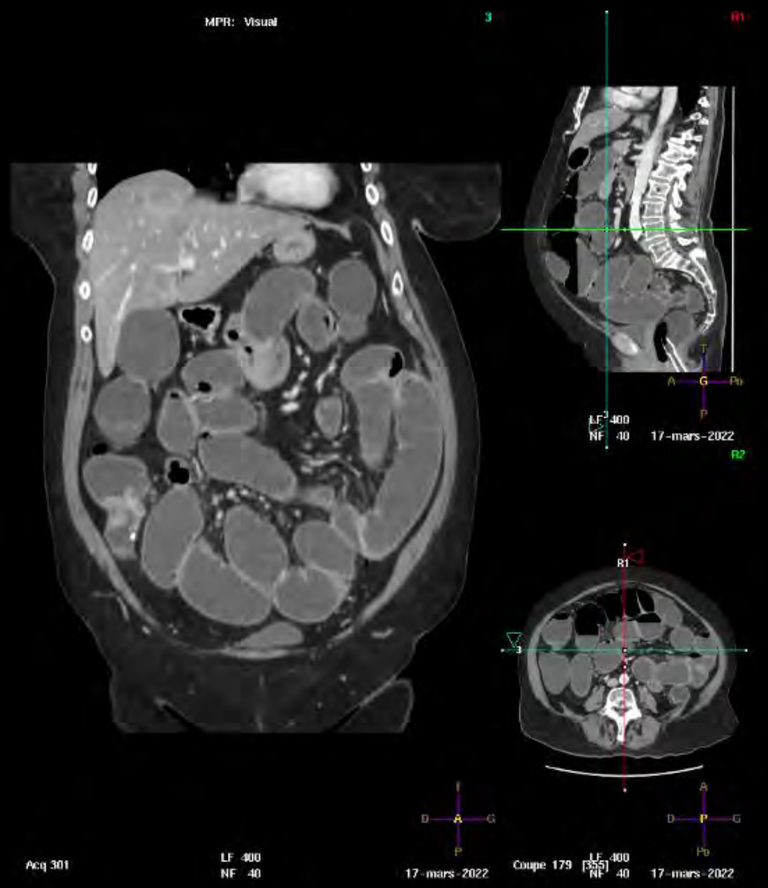
Diagnostique

- Femme 75 ans
- Antécédents hystérectomie et APP il y a 20 ans
- Douleurs abdominales depuis 1 semaine
- Arrêt du transit / gaz depuis 2 jours
- Occlusion, autres



Hôpital du Valais
Spital Wallis

Diagnostique

- Homme 65 ans. Polypes anamnestiques.
- J2 endarterectomies carotide.
- Episodes de rectorragies.
- Douleur abdominales persistantes.
- Diverticulite, masse, autre origine du saignement

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Diagnostique

- Homme de 58 ans
- Douleurs typiques en FID irradiant dans le testicule
- Calcul urinaire ?

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Staging

- <u>Questions du chirurgien / oncologue :</u>
  - Siège de la lésion
  - Extension de la tumeur.
  - Extension aux organes voisins (uretères, vessie, duodénum, estomac, pancréas).
  - ADP
  - Métastases (hépatiques, pulmonaires)
  - Carcinose péritonéale
  - Occlusion (chirurgie rapide / stent colique)

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Staging

Preoperative Chemotherapy for Operable Colon Cancer: Mature Results of an International Randomized Controlled Trial

Dion Morton, MD[1]; Matthew Seymour, MD[2]; Laura Magill, PhD[3]; Kelly Handley, PhD[3]; James Glasbey, MD[1]; Bengt Glimelius, MD[4]; Andy Palmer[3]; Jenny Seligmann, MD[2]; Søren Laurberg, MD[5]; Keigo Murakami, MD[6]; Nick West, MD[6]; Philip Quirke, FMedSci[6]; and Richard Gray, MSc[7]; on behalf of the FOxTROT Collaborative Group

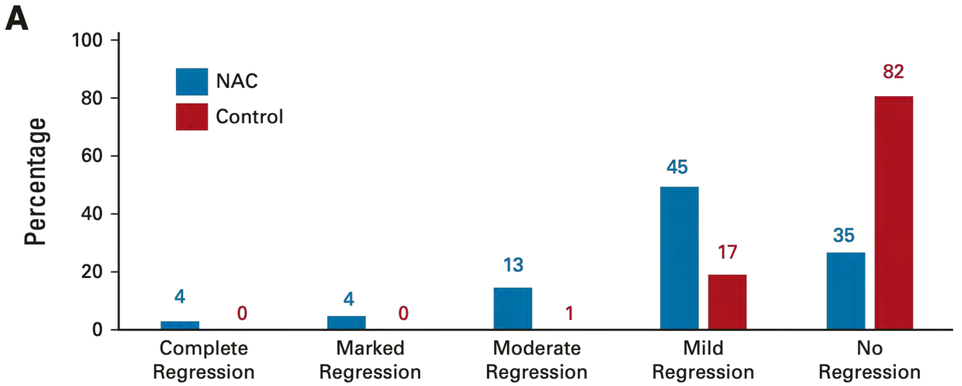
PURPOSE Neoadjuvant chemotherapy (NAC) has potential advantages over standard postoperative chemotherapy for locally advanced colon cancer but requires formal evaluation.

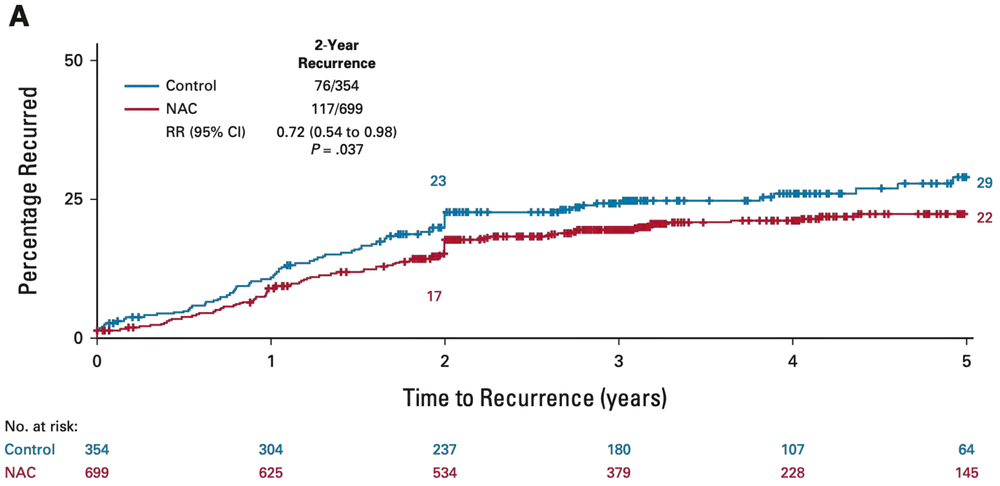
METHODS Patients with radiologically staged T3-4, N0-2, M0 colon cancer were randomly allocated (2:1) to 6 weeks oxaliplatin-fluoropyrimidine preoperatively plus 18 postoperatively (NAC group) or 24 weeks postoperatively (control group). Patients with *RAS*-wildtype tumors could also be randomly assigned 1:1 to receive panitumumab or not during NAC. The primary end point was residual disease or recurrence within 2 years. Secondary outcomes included surgical morbidity, histopathologic stage, regression grade, completeness of resection, and cause-specific mortality. Log-rank analyses were by intention-to-treat.

RESULTS Of 699 patients allocated to NAC, 674 (96%) started and 606 (87%) completed NAC. In total, 686 of 699 (98.1%) NAC patients and 351 of 354 (99.2%) control patients underwent surgery. Thirty patients (4.3%) allocated to NAC developed obstructive symptoms requiring expedited surgery, but there were fewer serious postoperative complications with NAC than with control. NAC produced marked T and N downstaging and histologic tumor regression (all $P < .001$). Resection was more often histopathologically complete: 94% (648/686) versus 89% (311/351), $P < .001$. Fewer NAC than control patients had residual or recurrent disease within 2 years (16.9% [118/699] *v* 21.5% [76/354]; rate ratio, 0.72 [95% CI, 0.54 to 0.98]; $P = .037$). Tumor regression correlated strongly with freedom from recurrence. Panitumumab did not enhance the benefit from NAC. Little benefit from NAC was seen in mismatch repair–deficient tumors.

CONCLUSION Six weeks of preoperative oxaliplatin-fluoropyrimidine chemotherapy for operable colon cancer can be delivered safely, without increasing perioperative morbidity. This chemotherapy regimen, when given preoperatively, produces marked histopathologic down-staging, fewer incomplete resections, and better 2-year disease control. Histologic regression after NAC is a strong predictor of lower postoperative recurrence risk so has potential use as a guide for postoperative therapy. Six weeks of NAC should be considered as a treatment option for locally advanced colon cancer.

J Clin Oncol 41:1541-1552.





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Staging

T1/T2

T3

T4

Table 1. WE-MDCT T-stage and histopathological T-stage classification

WE-MDCT T-staging	Histopathology T-staging			
N	T1/T2	T3	T4	Total
T1/T2	6	1	0	7
T3	4	26	2	32
T4	0	5	9	14
Total	10	32	11	53

E. Sibileau Abom Imaging 2014

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Staging

Table 3. Accuracy of each criterion for the N+ staging vs. N0 staging

Criteria	DP (%)	Se (%)	Sp (%)	PPV (%)	NPV (%)
Lymph node density after IV ≥ 100 HU	77.4	90.9	67.7	66.7	91.3
Number ≥ 3	66	86.4	51.6	55.9	84.2
Size ≥ 5 mm	69.8	95.5	51.6	58.3	94.1
$N \geq 3$ + size ≥ 5 mm + density ≥ 100 HU	77.4	77.3	77.4	70.8	82.8

E. Sibileau Abom Imaging 2014

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Staging

CT for lymph node staging of Colon cancer: not only size but also location and number of lymph node count

Eun Kyoung Hong[1,2,5] · Federica Landolfi[1,3] · Francesca Castagnoli[1,4] · Sae Jin Park[5] · Judith Boot[1] · Jose Van den Berg[1,6] · Jeong Min Lee[5] · Regina Beets-Tan[1,2]

Received: 1 January 2021 / Revised: 3 March 2021 / Accepted: 9 March 2021

Abstract

Purpose To evaluate the diagnostic accuracy of imaging features to predict lymph node status of colon cancer using CT.

Methods This was a retrospective study from 2 tertiary hospitals in South Korea and Netherlands. 317 Colon cancer patients who underwent primary surgical treatment were included. Number of lymph nodes according to the anatomical location, size, cluster, degree of attenuation, shape, presence of internal heterogeneity and ill-defined margin of the lymph node were assessed and compared according to histological lymph node status.

Results The largest short diameter of lymph node and presence of internal heterogeneity of lymph node showed significant association with malignant lymph node status ($P < 0.001$ and $P = 0.041$, respectively). The ROC curve analysis revealed AUC of 0.703 for the largest short diameter of lymph node ($P < 0.001$), and AUC of the presence of internal heterogeneity was 0.630 ($P < 0.001$). In addition, our study showed that a total number of lymph nodes, regardless of size, ($P = 0.022$) and number of lymph nodes in peritumoral area ($P < 0.001$) and along the mesenteric vessels ($P < 0.001$) on CT demonstrated significant association with malignant status of lymph nodes in colon cancer.

Conclusions There were significant associations between lymph node status and imaging features of lymph nodes on CT in colon cancer patients. The largest short diameter of lymph node and presence of internal heterogeneity can be used to predict the malignant status of lymph node in colon cancer patients. Also, the number of lymph nodes near the colonic tumor should be considered in assessment of colon cancer lymph node involvement on CT.

Table 2 Univariate and multivariate logistic regression analyses of imaging parameters in predicting lymph node status of colon cancer

	Univariate		Multivariate		ROC curve				
	OR	*P*	OR	*P*	AUC	*P* for ROC	Sensitivity	Specificity	Cut-off
Total LN count	1.18	**< 0.001**			0.69	**< 0.001**	53.24	73.03	> 10
N1 LN count	1.11	**< 0.001**			0.71	**< 0.001**	57.97	73.03	> 6
N2 LN count	1.25	**< 0.001**			0.64	**< 0.001**	51.45	69.66	> 2
N3 LN count	1.08	0.272							
N1 + N2 LN count	1.13	**< 0.001**			0.70	**< 0.001**	47.48	80.90	> 10
Largest short diameter	1.37	**0.002**	1.34	**< 0.001**	0.69	**< 0.001**	52.94	79.17	> 7.95
Largest long diameter	1.16	**0.012**			0.62	**0.008**	31.76	87.50	> 13.73
Short/Long diameter ratio (> 0.8)	1.34	0.403							
Highest mean HU	0.99	0.240							
Highest SD HU	1.04	**0.032**			0.57	0.103	42.35	75.00	> 23.13
Cluster	2.02	**0.002**			0.59	**0.001**	64.71	53.41	
Internal heterogeneity	3.00	**< 0.001**	2.09	**0.041**	0.63	**< 0.001**	69.41	56.94	
Ill-defined margin	1.35	0.350							

LN Lymph node, *HU* Hounsfield unit, *SD* Standard deviation, *OR* Odds Ratio, *AUC* Area under curve, *CI* Confidence interval, *ROC* Receiver Operating Curve, *Cut-off* cut-off values of continuous variables for the prediction of lymph node status of colon cancer

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Staging

- Important taux de récidive
- Mauvais pronostique
- MRI est capable identifier mauvais pronostique en pré-opératoire
- Intérêt traitement néoadjuvant

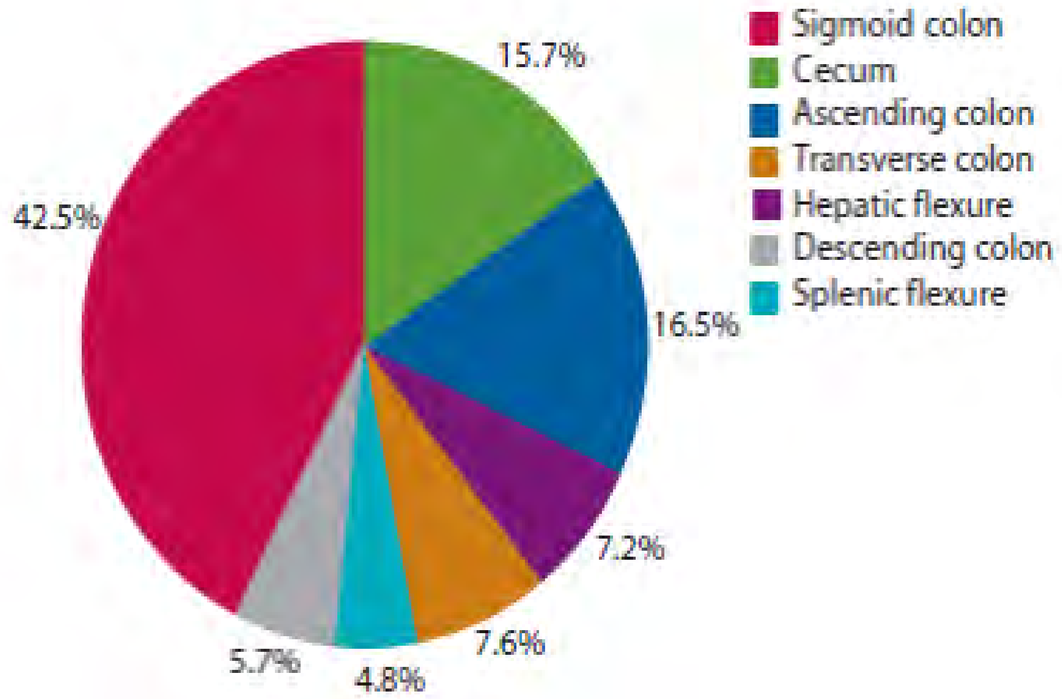

FIGURE 1. Anatomic site distribution of colon cancers.

Dis Colon Rectum. 2010 Jan;53(1):57-64.

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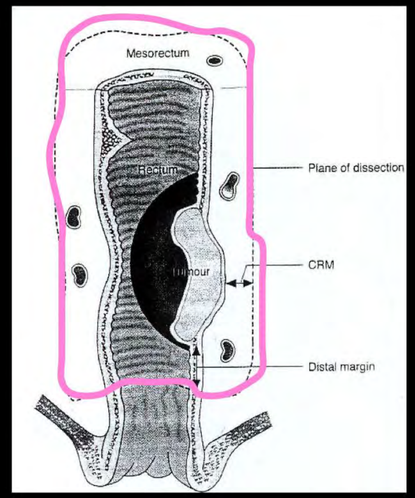
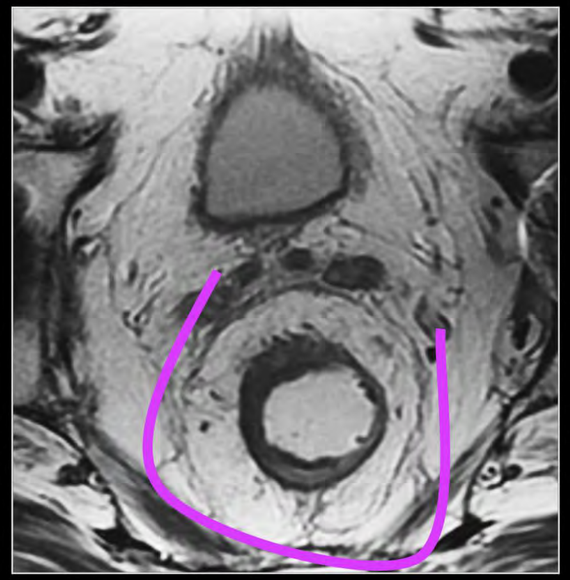
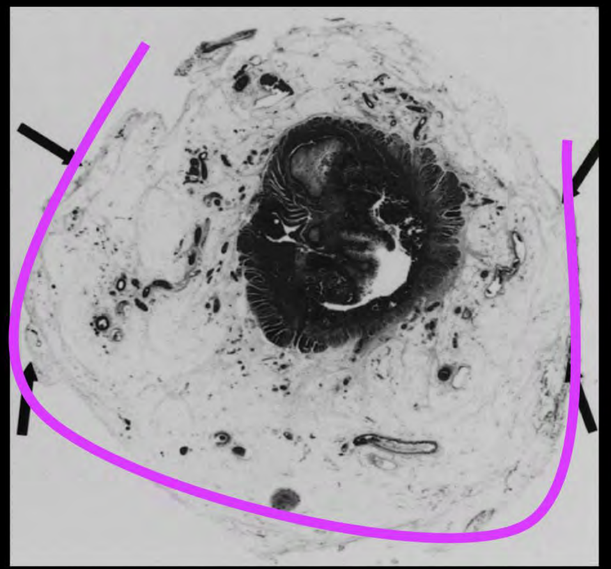
Staging







Brown G et al. AJR 2004 , 182 : 431-439

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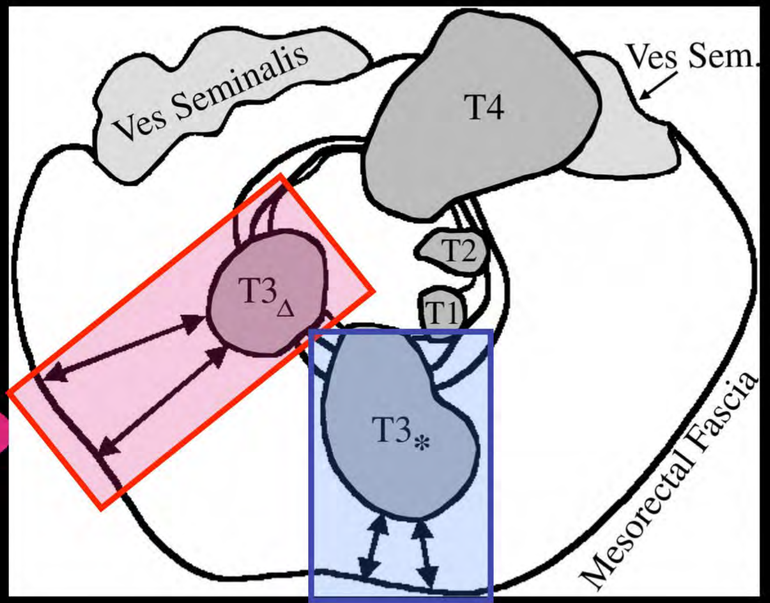
Staging

T-Stage et marges latérales de résection



Beets-Tan RG, Beets G. Radiology 2004 ; 232 : 335-346

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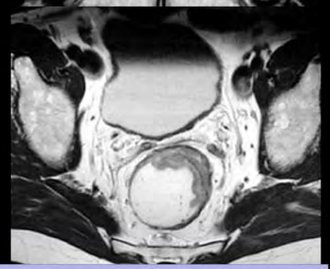
Staging

Trois situations différentes

T1-T2-N0

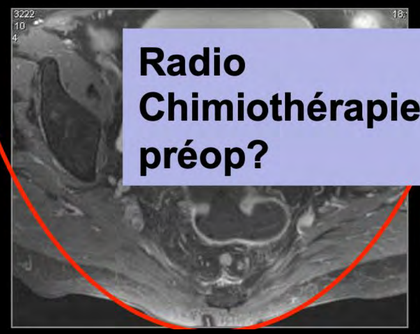


Pas de radio
Chimiothérapie

T2? / T3a/b ?

GG ? / ADP ?

Pas de radio
Chimiothérapie
préop ?



Radio
Chimiothérapie
préop?

T3-T4

Radio
Chimiothérapie

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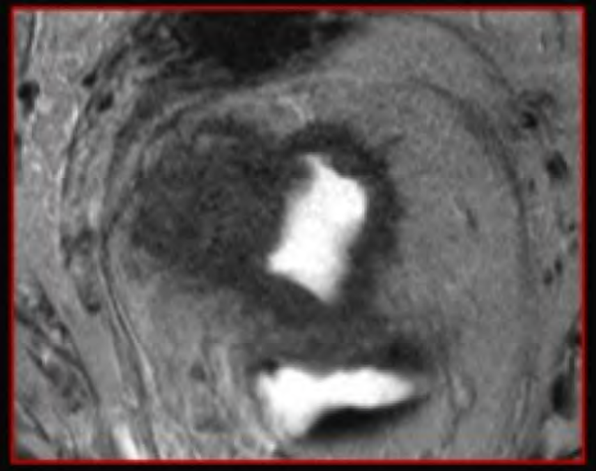
Staging

- Facteur pronostique important (plus important que T)
- Distance séparant la tumeur – ou adénopathie située dans le mésorectum- du fascia recti

Plusieurs modes d'extension dans le mésorectum:

- Extension tumorale directe
- Ganglion tumoral dans le mésorectum
- Invasion veineuse
- Invasion lymphatique
- Extension tumorale périneurale

- CRM+ si < 1mm à l'histologie
- >5mm à l'IRM, >2mm à l'ana-path



Groupe	Récidive	Survie à 5 ans
1: 1 mm	33%	39%
2: > 1 to 5 mm	5%	70%
3: > 5 mm	6%	90%

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Thérapies loco-régionales

World Journal of Clinical Oncology

Submit a Manuscript: http://www.f6publishing.com

World J Clin Oncol 2017 June 10; 8(3): 190-202

DOI: 10.5306/wjco.v8.i3.190

ISSN 2218-4333 (online)

REVIEW

Multidisciplinary approach of colorectal cancer liver metastases

Hôpital du Valais
Spital Wallis

Thérapies loco-régionales

- **Traitement des métastases hépatiques**
  - **Thermo-ablation**
  - **Radio-embolisation**
  - **Chimiothérapie intra-artérielle**
- Préparation à la chirurgie hépatique
  - Embolisation portale
- Chirurgie guidée par navigation sous contrôle de l'imagerie

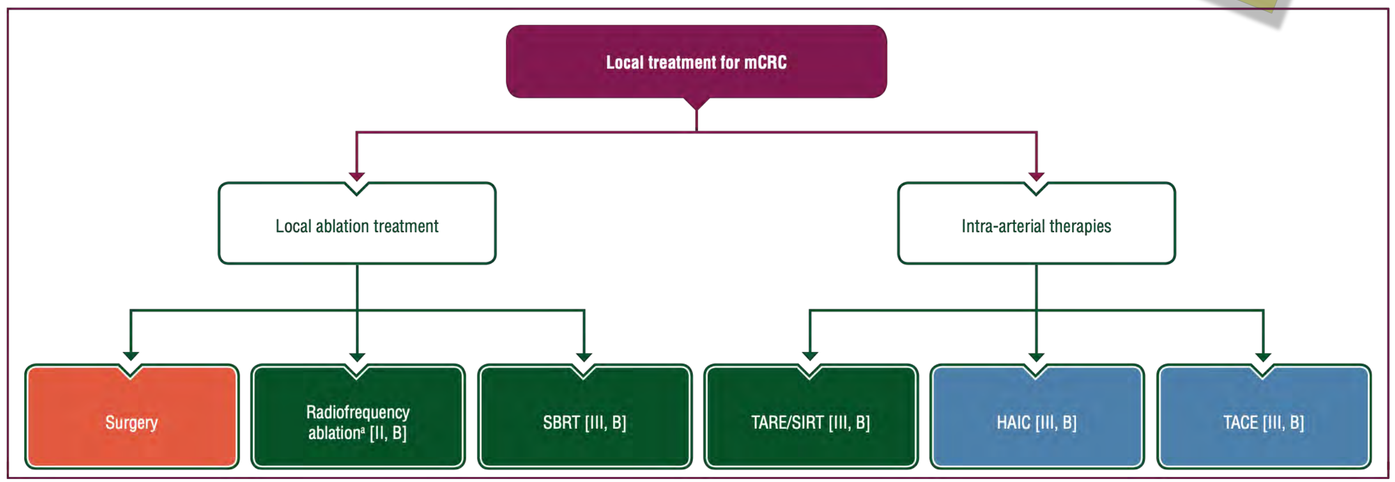

Figure 1. Local treatment of CRC metastases. Purple: general categories or stratification; red: surgery; dark green: radiotherapy; blue: systemic anticancer therapy; white: other aspects of management.
CRC, colorectal cancer; CRLM, colorectal liver metastasis; HAIC, hepatic arterial infusion chemotherapy; mCRC, metastatic colorectal cancer; OMD, oligometastatic disease; SBRT, stereotactic body radiotherapy; SIRT, selective internal radiotherapy; TA, thermal ablation; TACE, transarterial chemoembolisation; TARE, transarterial radioembolisation.
[a]In patients with unresectable CRLMs only, or OMD in the liver, TA can be considered for small metastases [III, B]. In patients with lung-only metastases or OMD including lung lesions, TA may be considered along with resection, according to tumour size, number, location, the extent of lung parenchyma loss, comorbidity or other factors [III, B].

A. Cervantes, vol 34; issue 1. 2023

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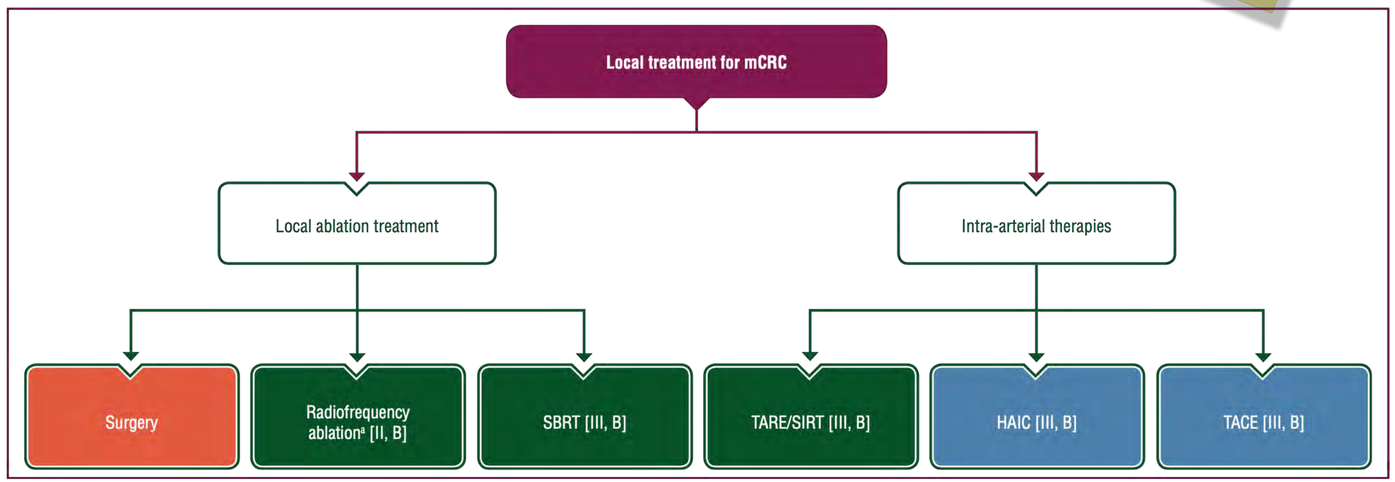
Thérapies loco-régionales

- Thermo-ablation
  - Patients non resécables
  - En combinaison avec hépatectomie
  - Coomorbidites / PS elevé
  - Petites lésion (< 3cm)
  - Post chirurgie hépatique



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A. Cervantes, vol 34; issue 1. 2023

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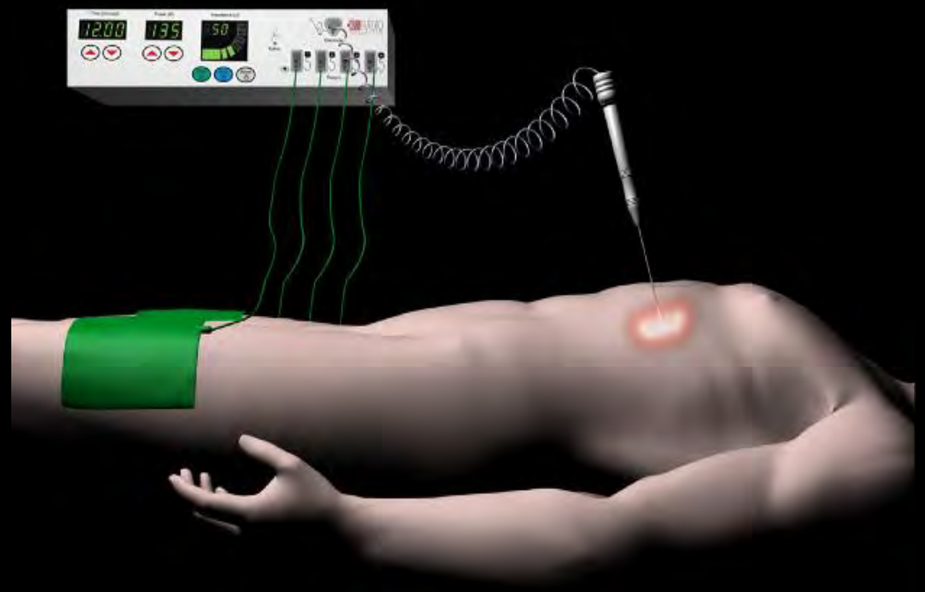
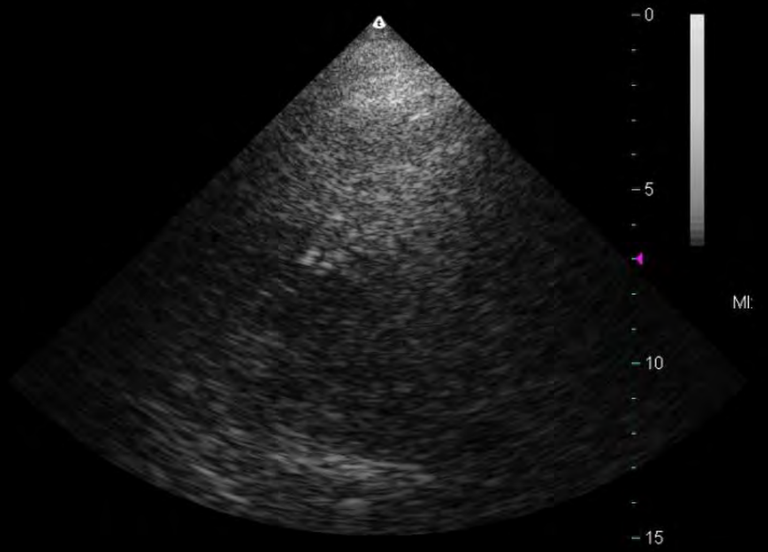
Thérapies loco-régionales





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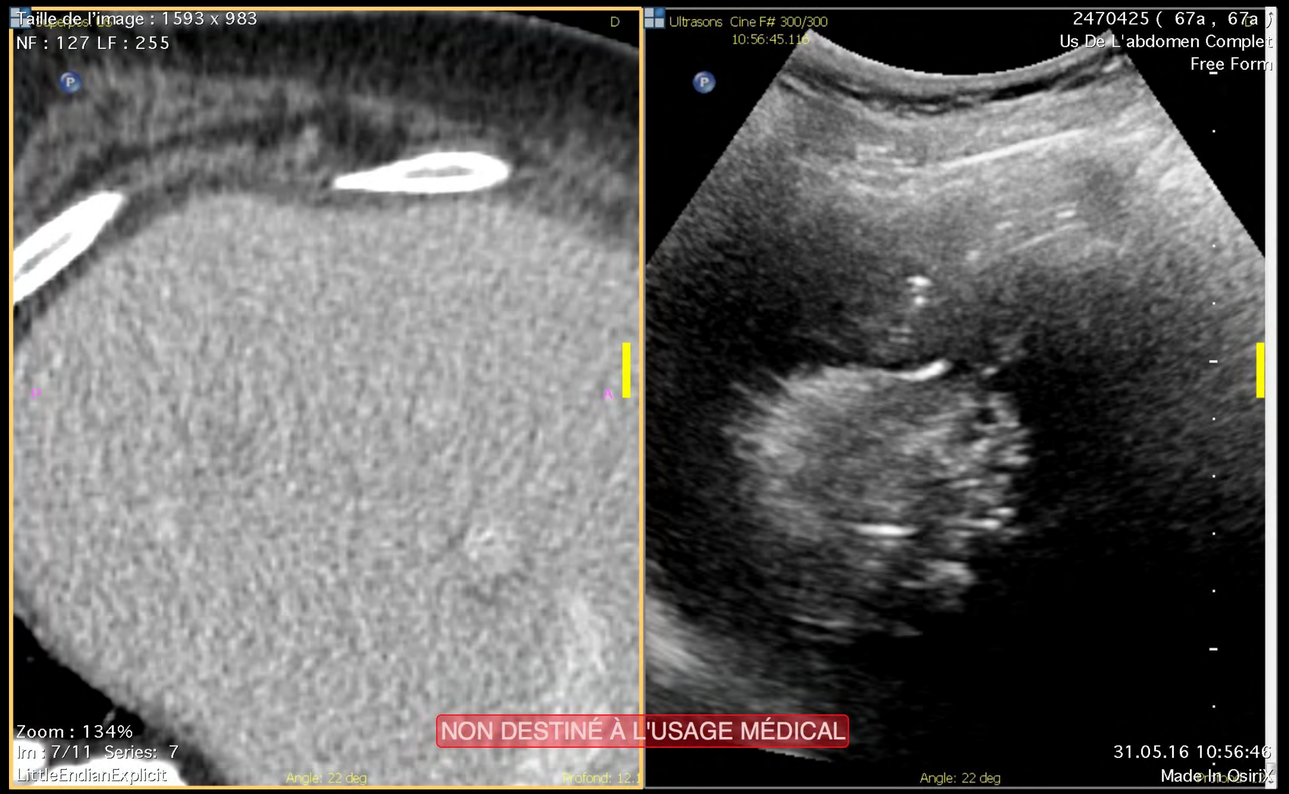
Thérapies loco-régionales



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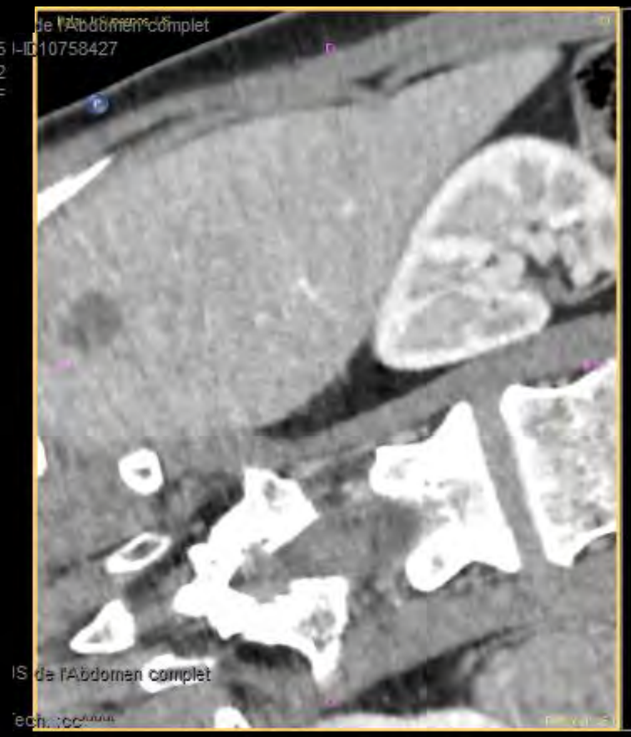
Spital Wallis

Thérapies loco-régionales



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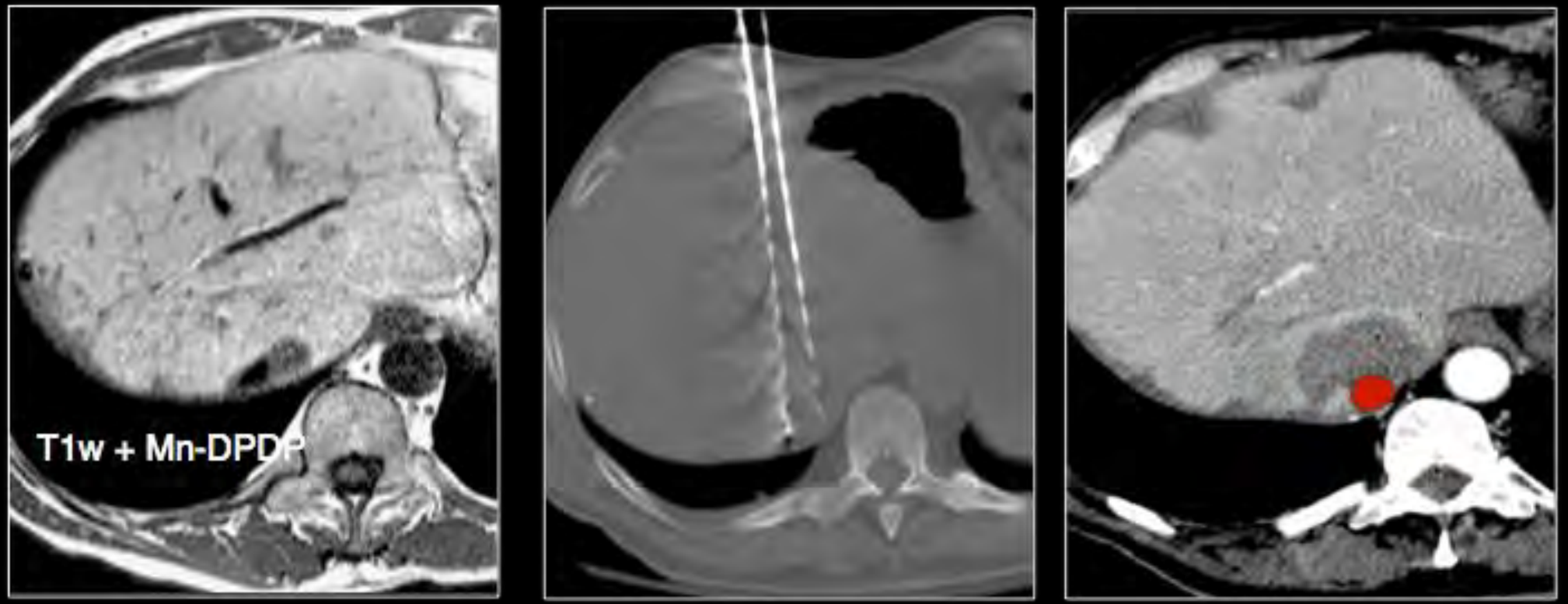
Spital Wallis

Thérapies loco-régionales



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Thérapies loco-régionales

- TACE / SIRT / HAC
  - Option pour patient non curatif
  - Mieux toléré
  - Combinaison?
  - Réfractaire aux chimiothérapies classiques
  - Post chirurgie hépatique

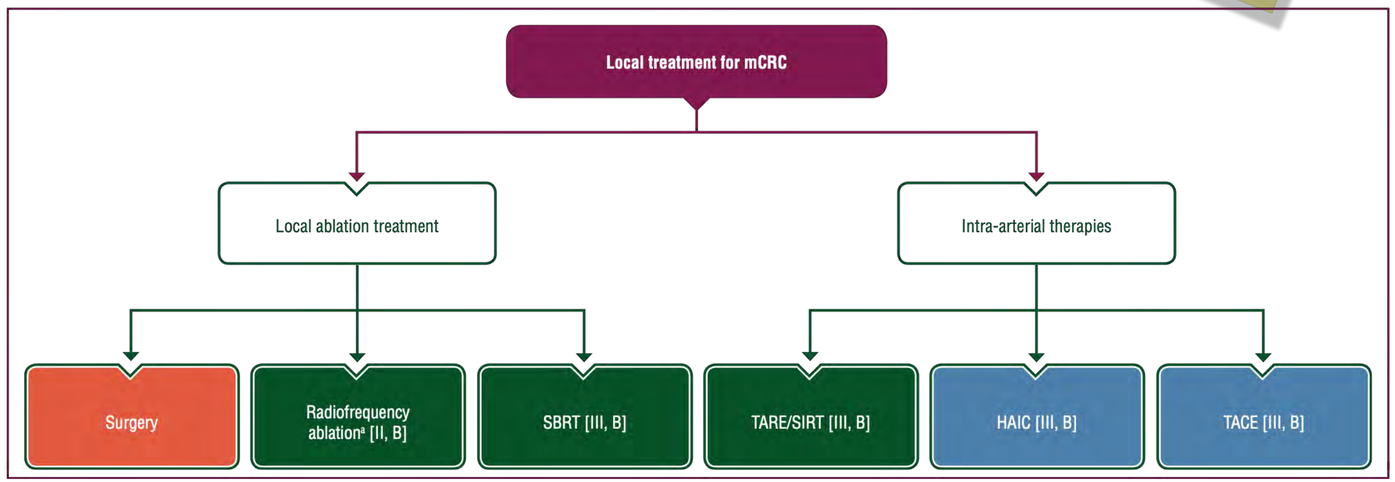

Figure 1. Local treatment of CRC metastases. Purple: general categories or stratification; red: surgery; dark green: radiotherapy; blue: systemic anticancer therapy; white: other aspects of management.
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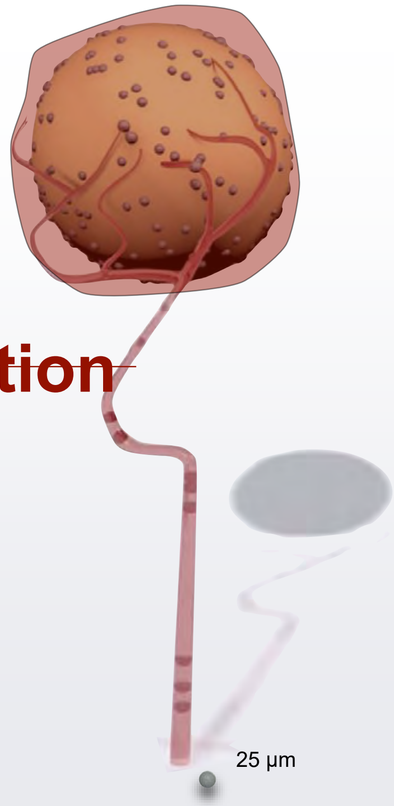
Thérapies loco-régionales

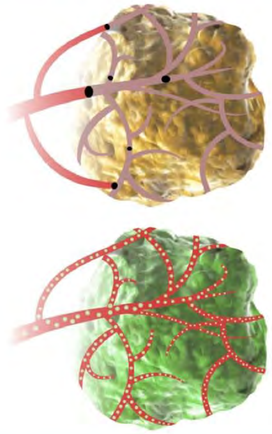
TARE

~~Irradiation~~



Conventional chemoembolization

- **Mechanism of action:** Delivery of a high-dose chemotherapy/ethiodized oil emulsion (yellow) followed by arterial embolisation to prevent drug washout and promote tumour ischaemia/hypoxia.
- **Particle size:** 100-500 µm



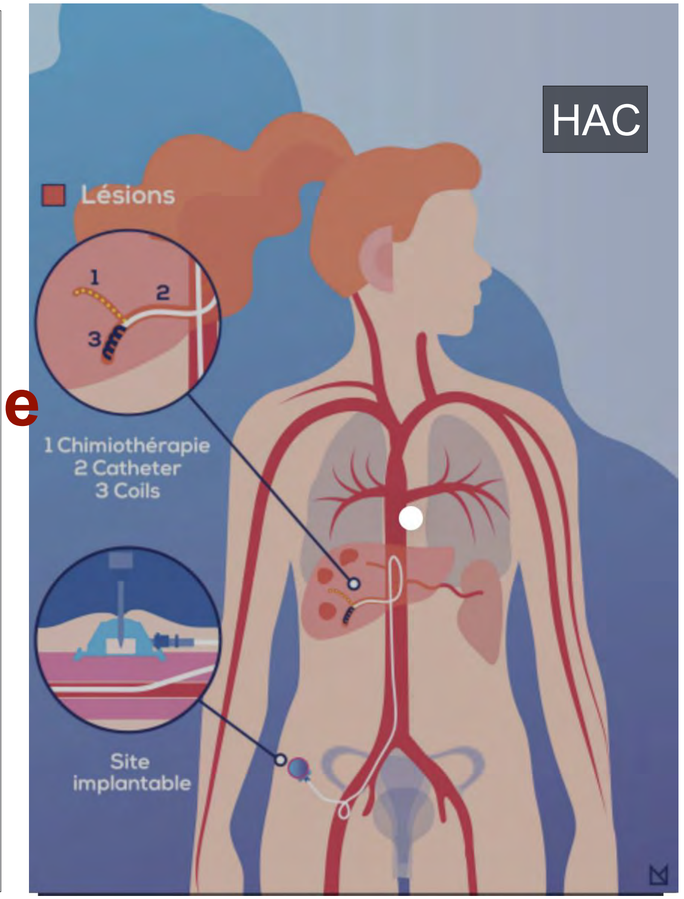
Radioembolization

- **Mechanism of action:** Delivery of β-emitting microspheres that provide local, high dose tumour radiation. The radiation affects tissues 2.5-11 mm from the delivered microsphere (green)
- **Particle size:** 20-60 µm

TACE

Cytotoxique

HAC



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Thérapies loco-régionales

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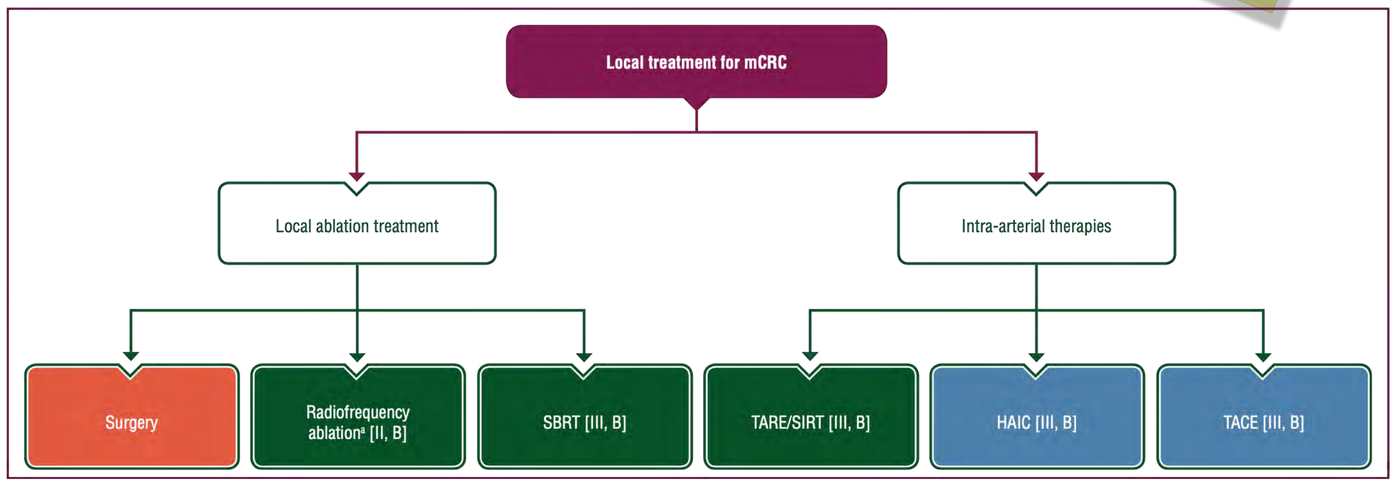
Thérapies loco-régionales

- Traitement des métastases hépatiques
  - Thermo-ablation
  - Radio-embolisation
  - Chimiothérapie intra-artérielle
- **Préparation à la chirurgie hépatique**
  - **Embolisation portale**
- Chirurgie guidée par navigation sous contrôle de l'imagerie



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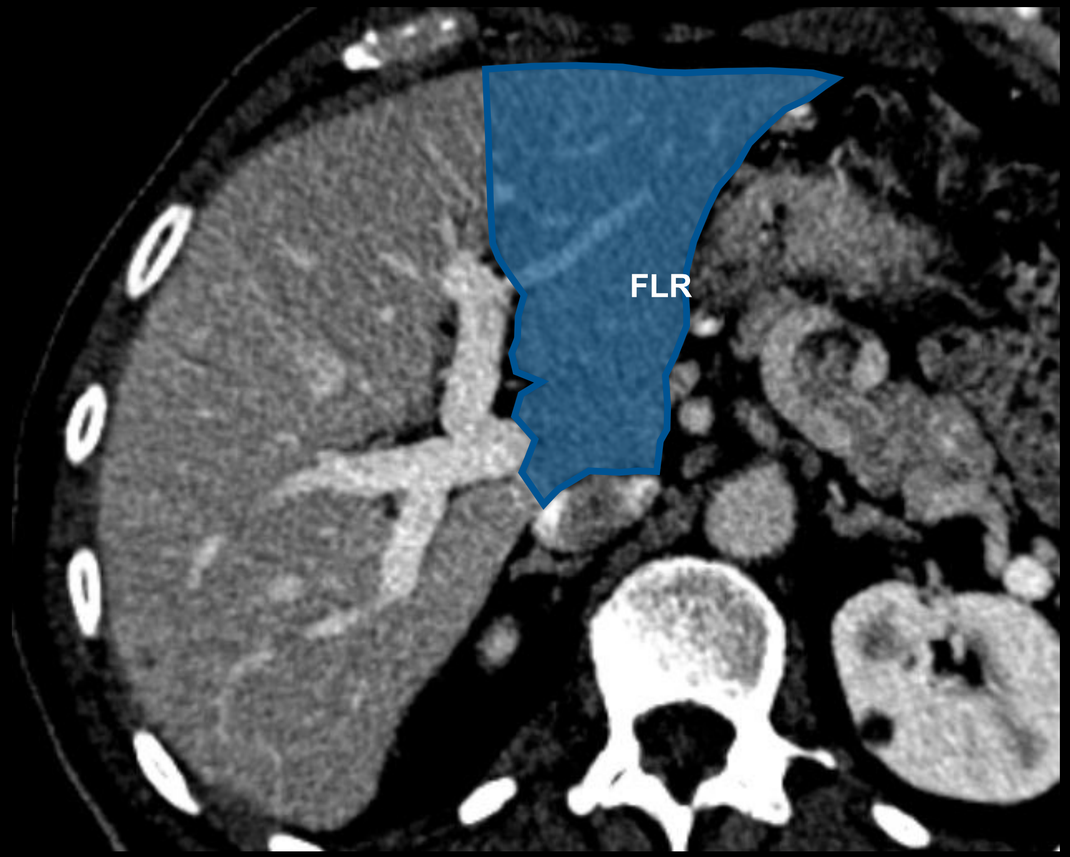
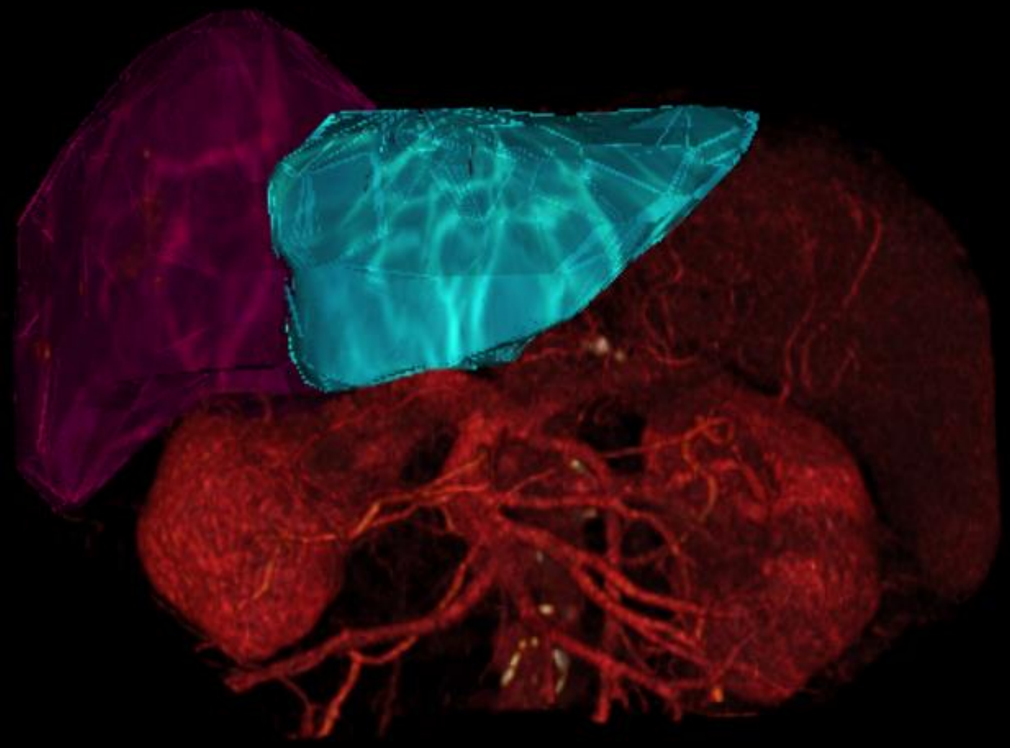
Thérapies loco-régionales





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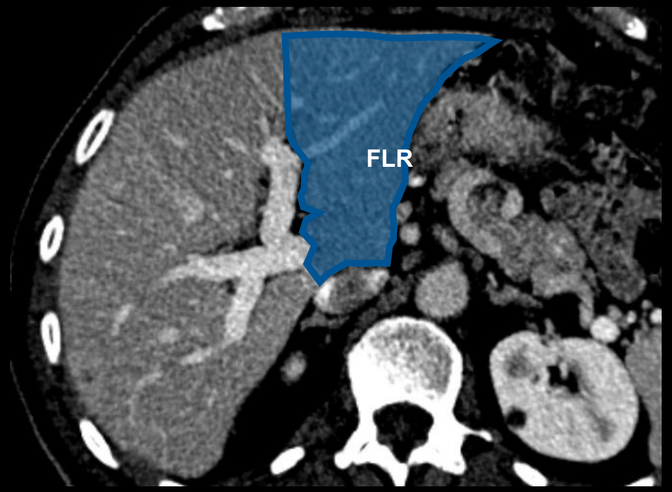
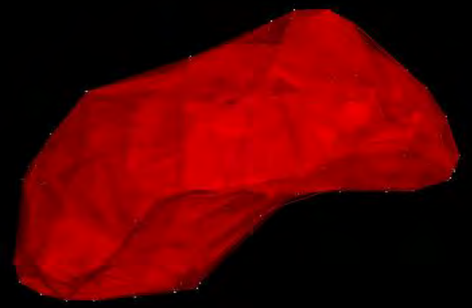
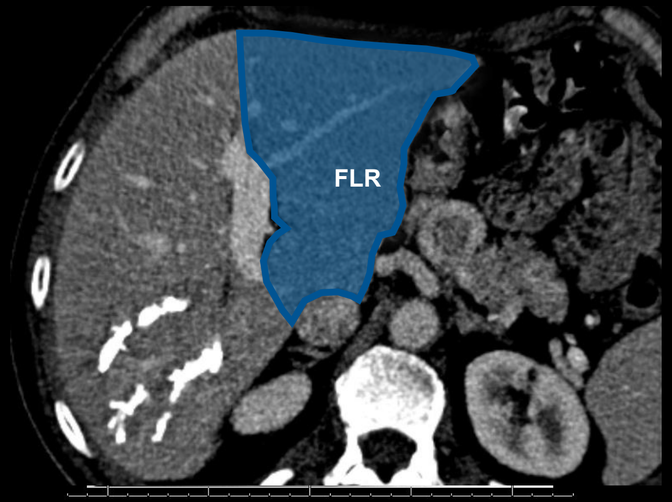
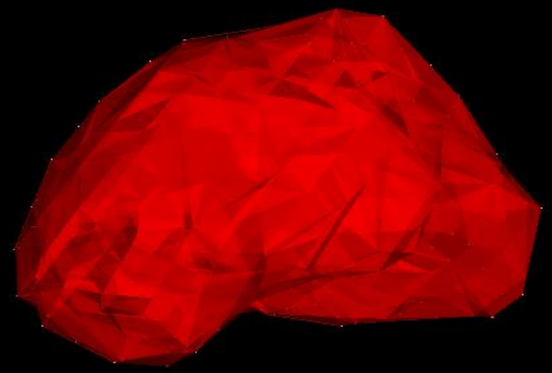
Thérapies loco-régionales





Volume: 328.9 cm^3





Volume: 561.1 cm^3

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Thérapies loco-régionales

- Traitement des métastases hépatiques
  - Thermo-ablation
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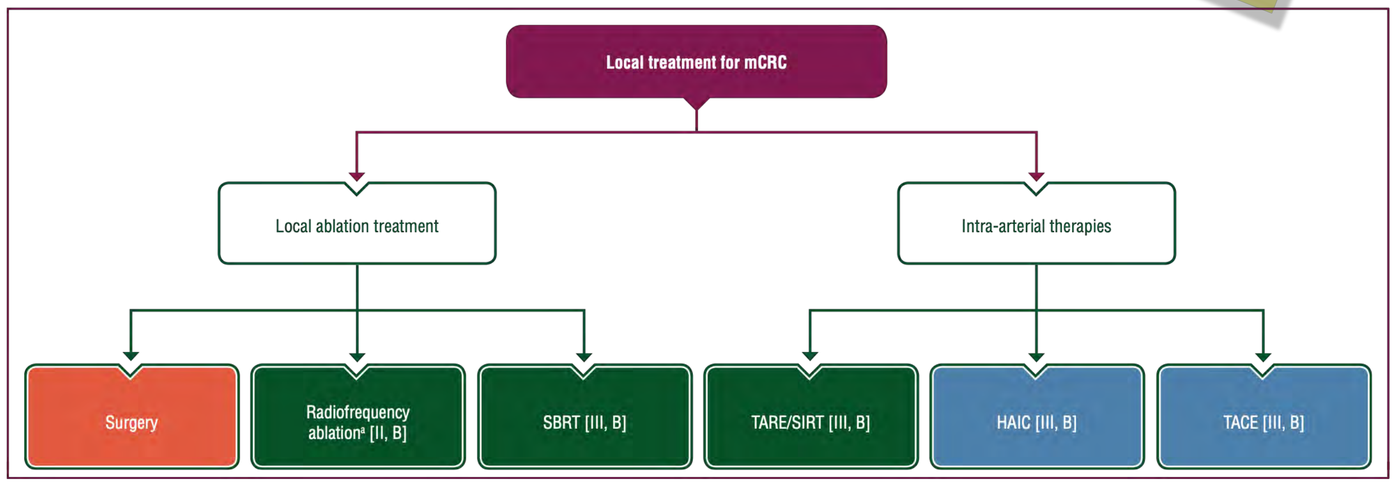

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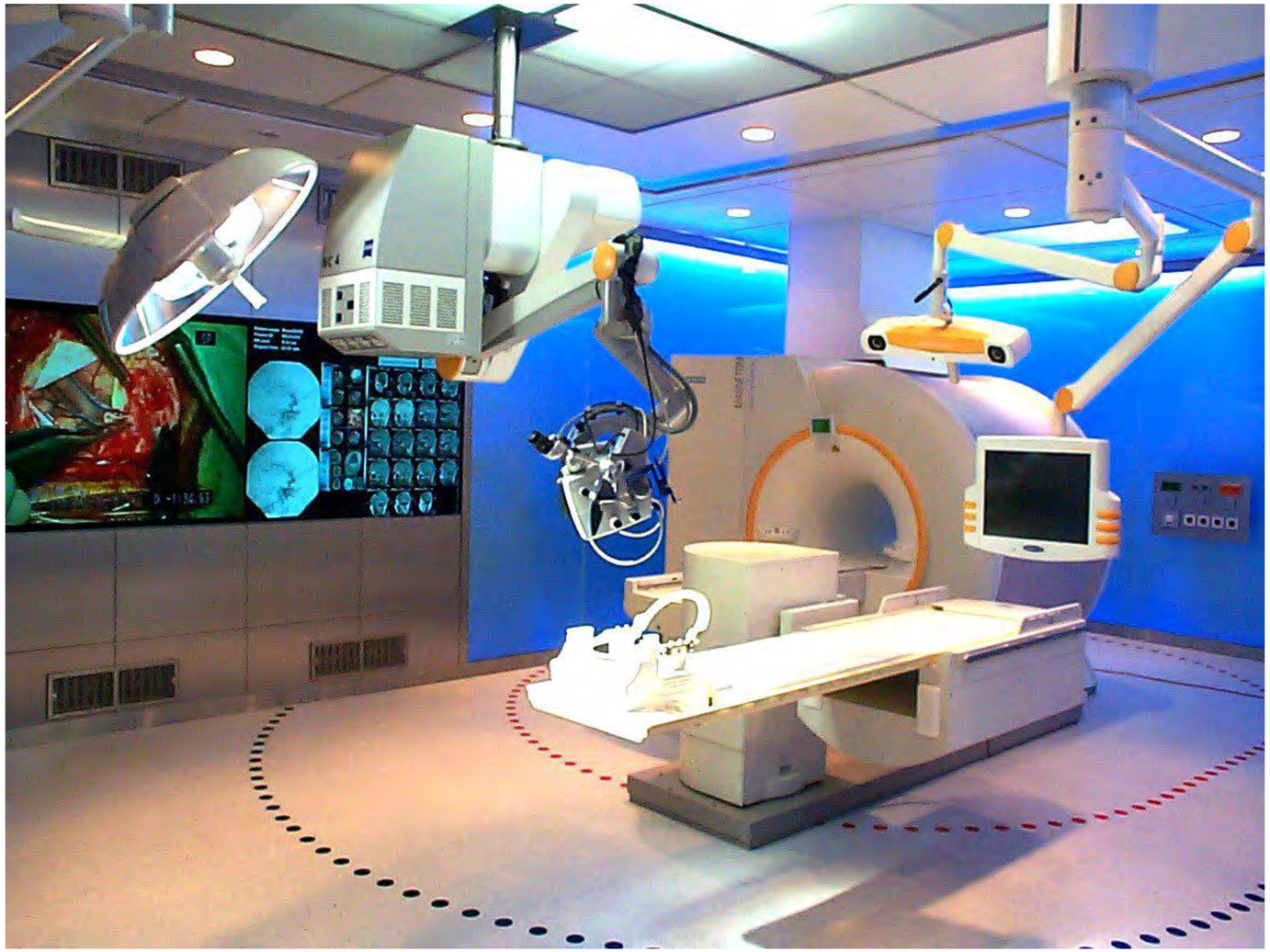
Thérapies loco-régionales



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Thérapies loco-régionales

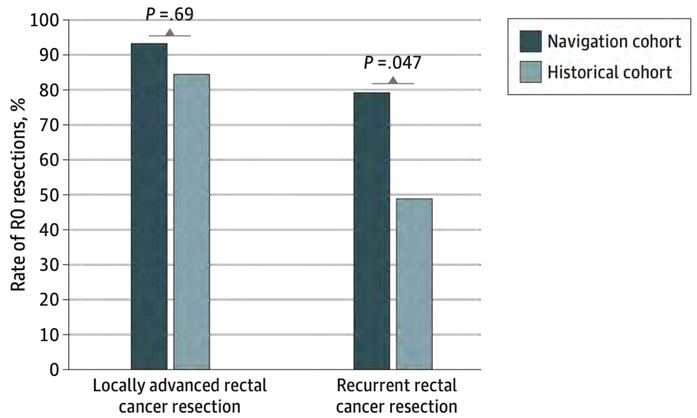
JAMA Network | Open

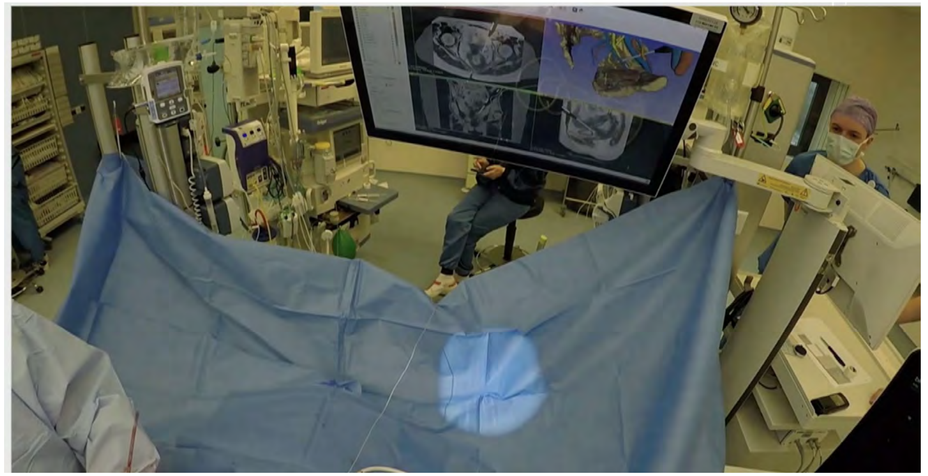
Original Investigation | Surgery

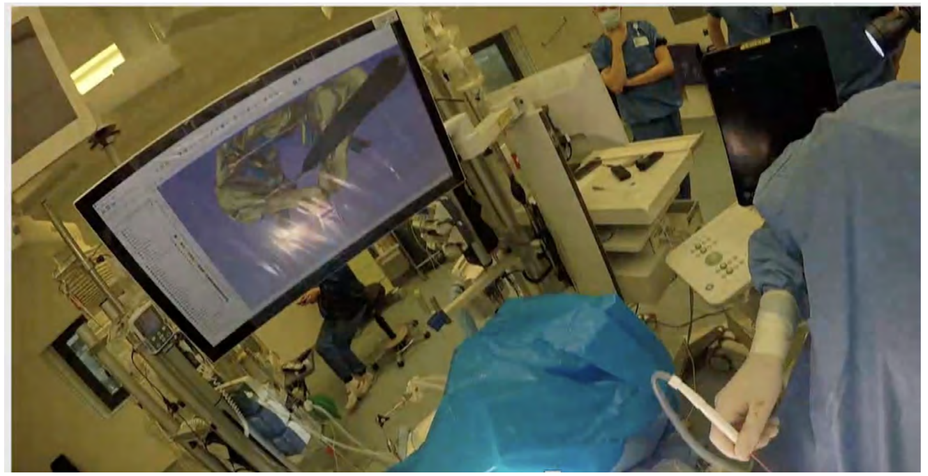
Association of Image-Guided Navigation With Complete Resection Rate in Patients With Locally Advanced Primary and Recurrent Rectal Cancer
A Nonrandomized Controlled Trial

Esther N. D. Kok, MD; Ruben van Veen, MSc; Harald C. Groen, MSc, PhD; Wouter J. Heerink, MSc, PhD; Nikie J. Hoetjes, MSc; Erik van Werkhoven, MSc; Geerard L. Beets, MD, PhD; Arend G. J. Aalbers, MD, PhD; Koert F. D. Kuhlmann, MD, PhD; Jasper Nijkamp, PhD; Theo J. M. Ruers, MD, PhD

MAIN OUTCOMES AND MEASURES The primary end point was the complete resection rate, measured by the amount of tumor-negative resection margin rates. Secondary outcomes were safety and usability of the system. Safety was evaluated by the number of navigation system–associated surgical adverse events. Usability was assessed from responses to a questionnaire completed by the participating surgeons after each procedure.







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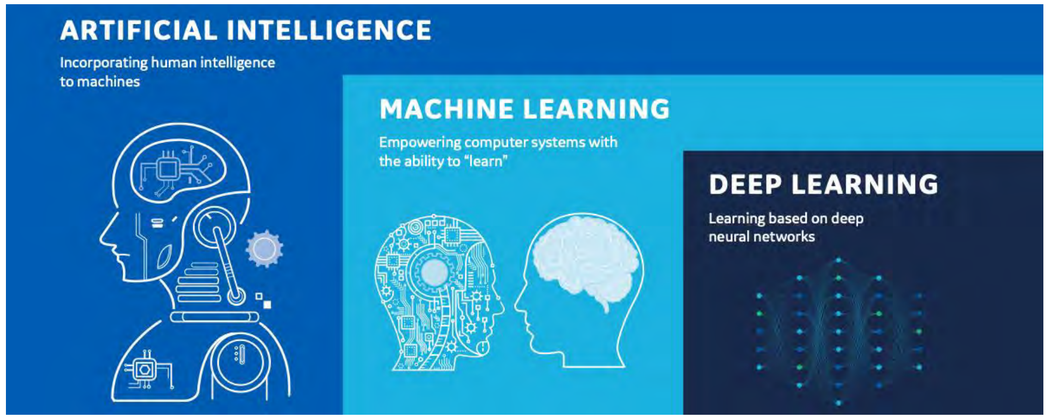
Intelligence artificielle

- IA : terme qui couvre la théorie et le développement de systèmes informatisés qui sont capables d'effectuer des tâches qui requiert normalement l'intelligence humaine
- Machine learning : système qui peut apprendre au travers de bases de données, de schémas et de caractéristiques pour prendre des décisions avec un minimum d'interventions humaines
    - Deep learning utilise le concept de réseau neuronal profond
    - DNN consiste en une couche d'équations mathématiques avec des millions de connections et paramètres qui est entrainé sur une base de données et peut traiter des millions de données



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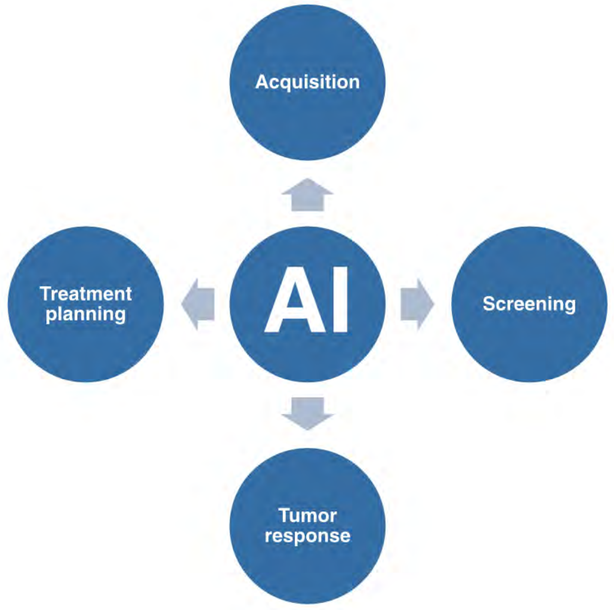
Intelligence artificielle

- Les logiciels d'intelligence artificielle en radiologie sont souvent conçus pour reproduire des tâches effectuées par le radiologue.
- Ils sont souvent entrainés par des annotateurs radiologues qui labellisent des images en montrant la correspondance entre les anomalies (=patterns visuels) et les diagnostics en découlant.
- L'idée principale en faisant ces tâches est d'assister le radiologue en lui facilitant la vie pour:
  - La détection d'anomalie
  - Les mesures automatiques
  - La caractérisation
- Avec pour objectif: un gain de performance diagnostique dans la détection et la caractérisation, un gain de temps, une priorisation de la liste de travail…



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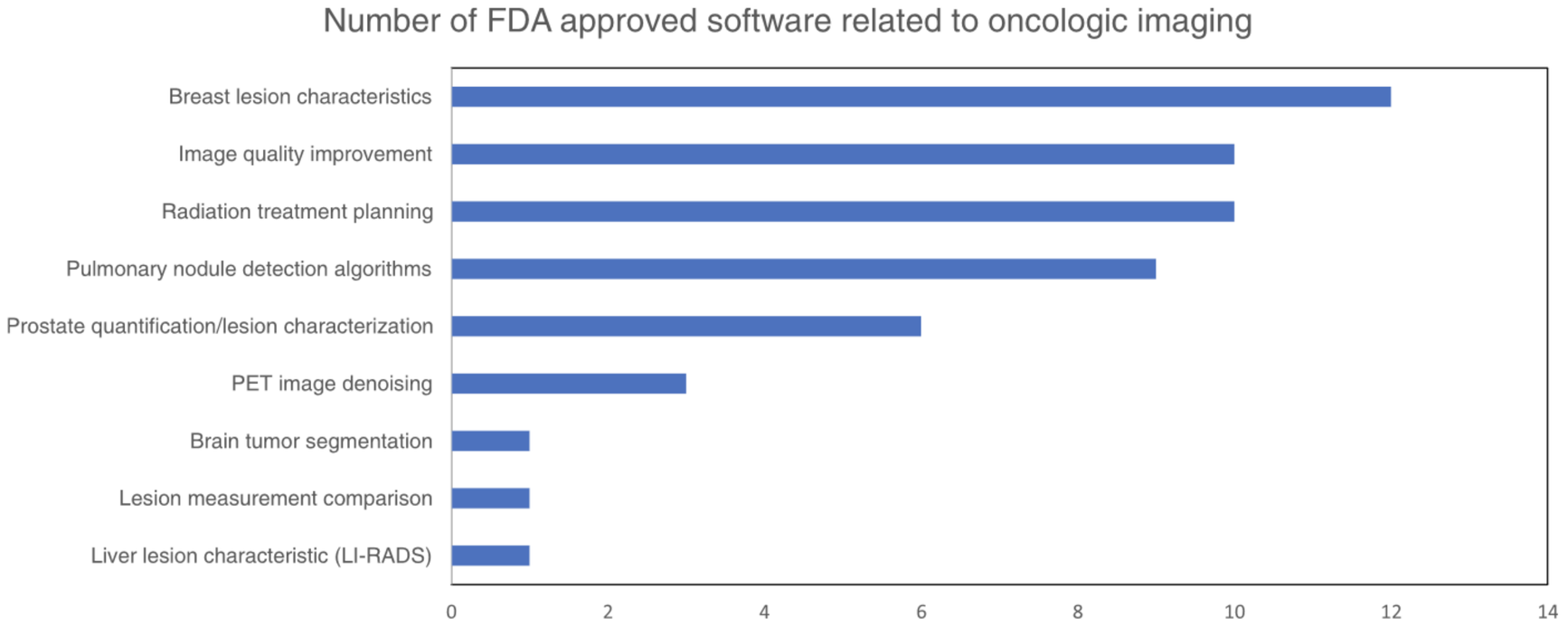
Intelligence artificielle



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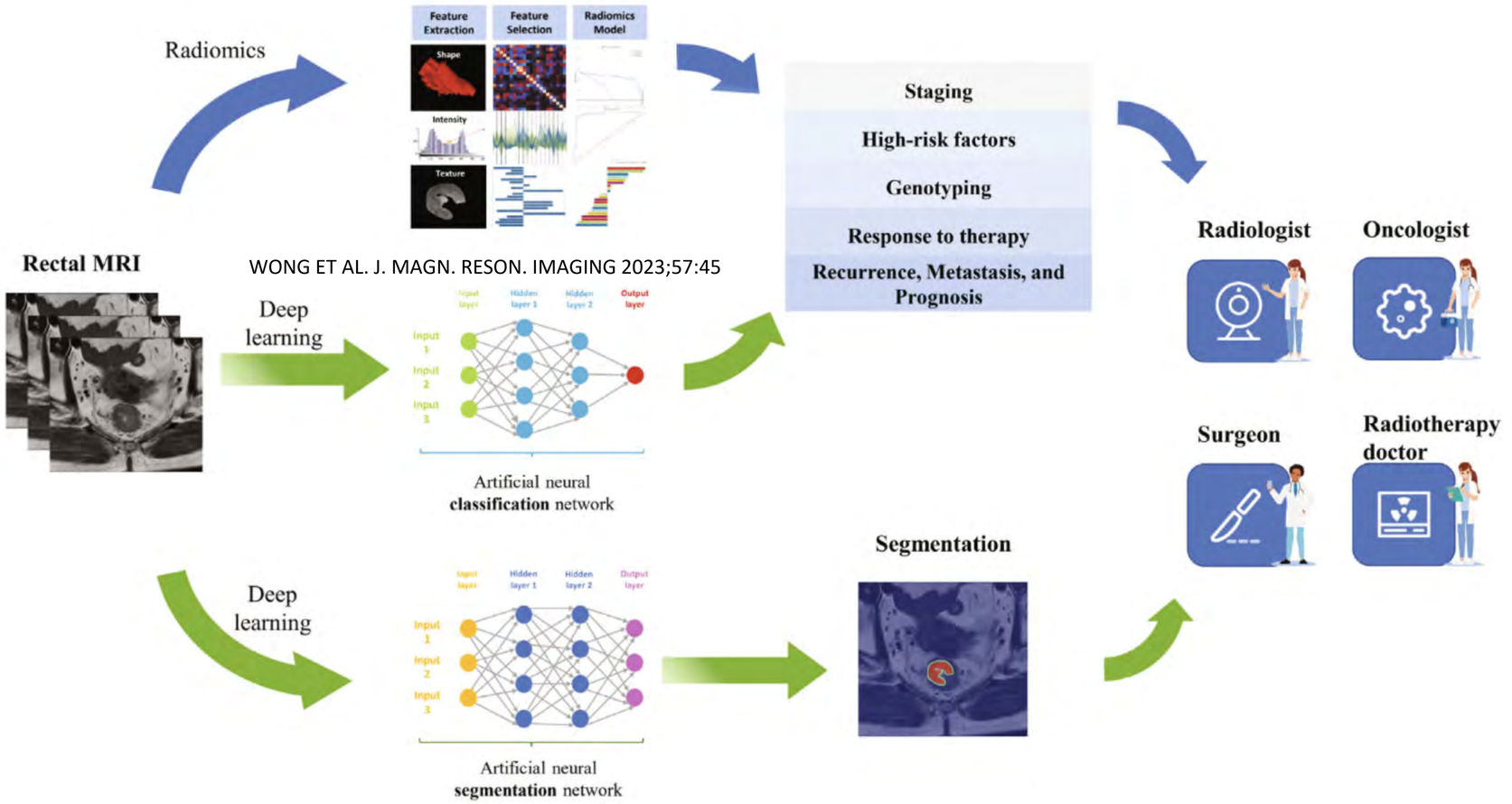

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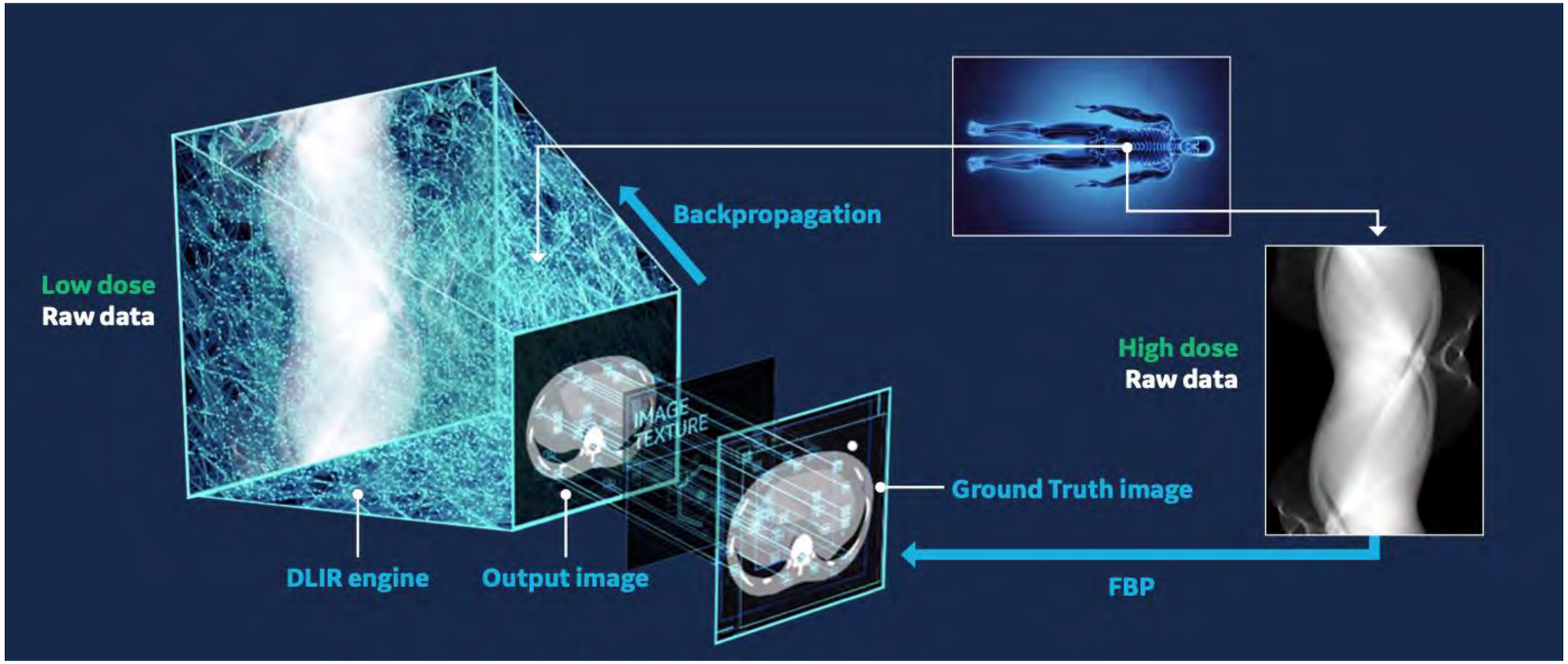

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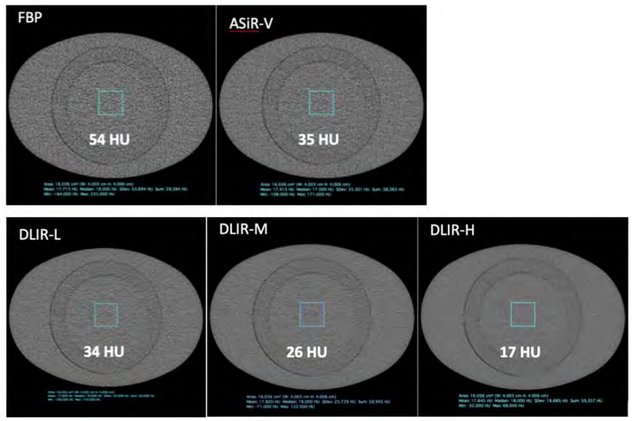
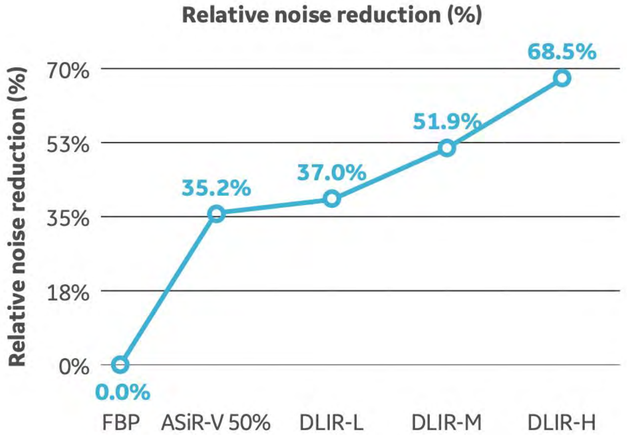
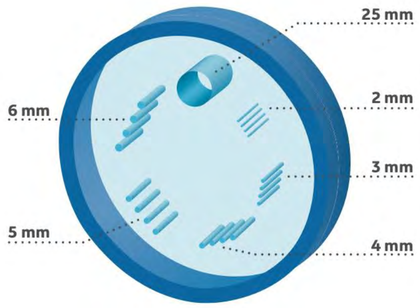
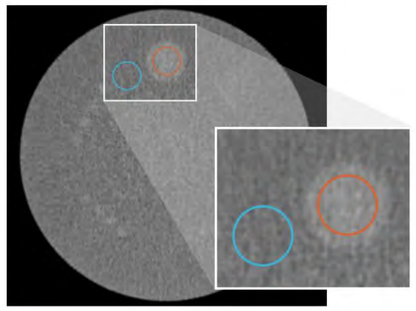
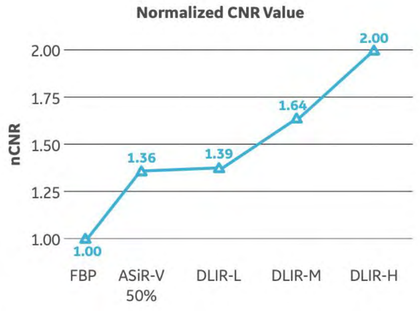


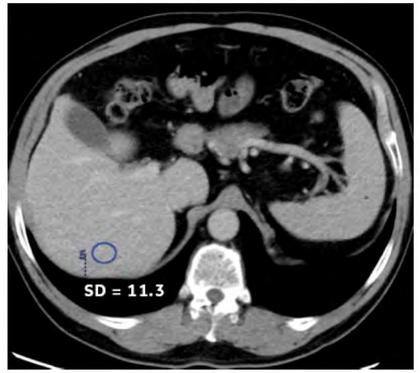




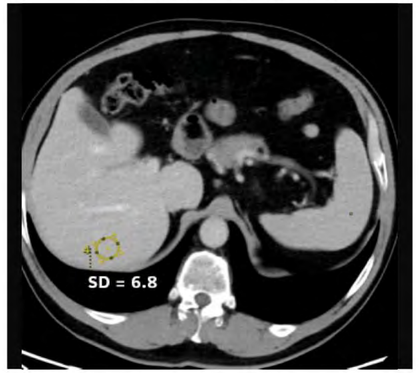




A: ASiR-V 50%
Prior exam with 10.38 mGy



B: DLIR-H
Follow-up exam with 5.1 mGy



C: ASiR-V 50%
Prior exam with 10.38 mGy

D: DLIR-H
Follow-up exam with 5.1 mGy

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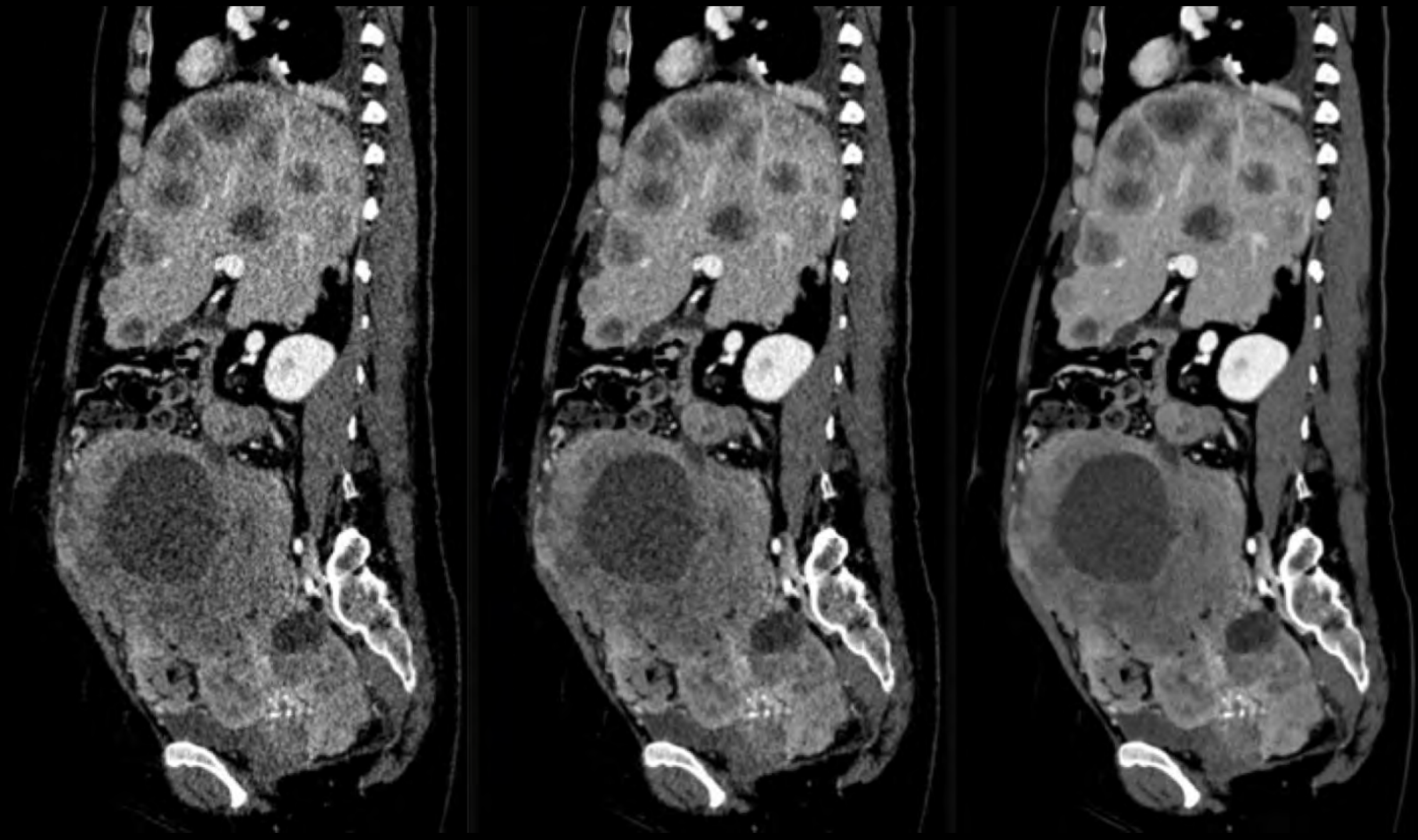
Intelligence artificielle



Reconstruction standard | Reconstruction itérative | TrueFidelity

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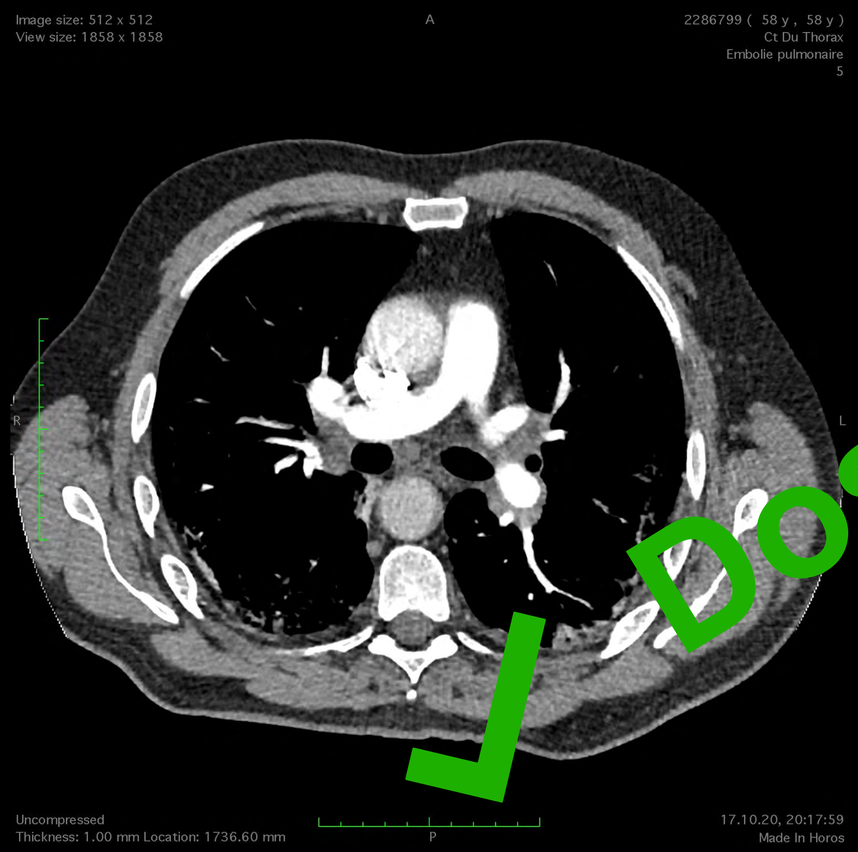
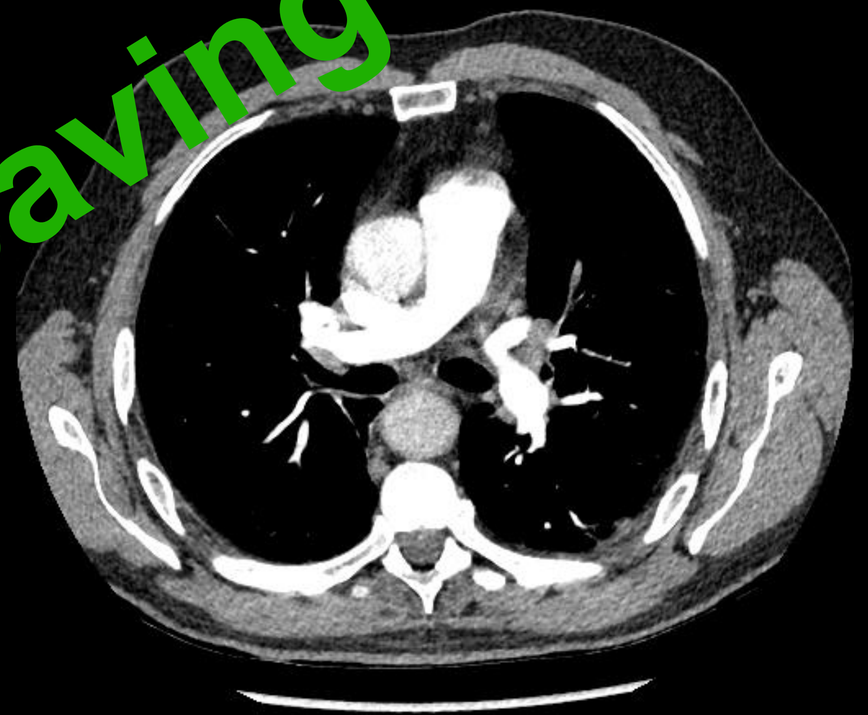
Spital Wallis

Intelligence artificielle

HOT TOPIC



Dose Saving



17/10/2020

60 ml

473 mGy/cm

30/10/2020

30 ml

245 mGy/cm

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Spital Wallis

Intelligence artificielle

- Jeunes patients 37ans
- Odynodysphagie et trismus
- Recherche d’abcès cervical

ASIR 40

TrueFidelity (50 kEV)

Take Home message

➢Rôle important de la radiologie dans la prise en charge et détection des cancers colo-rectaux

➢Alternative aux chimiothérapies

➢Plue value des outils d'IA pour l'aide au diagnostique et suivi

➢Importance d'un regard critique par la connaissance de ces nouveaux outils

➢Etude clinique…….