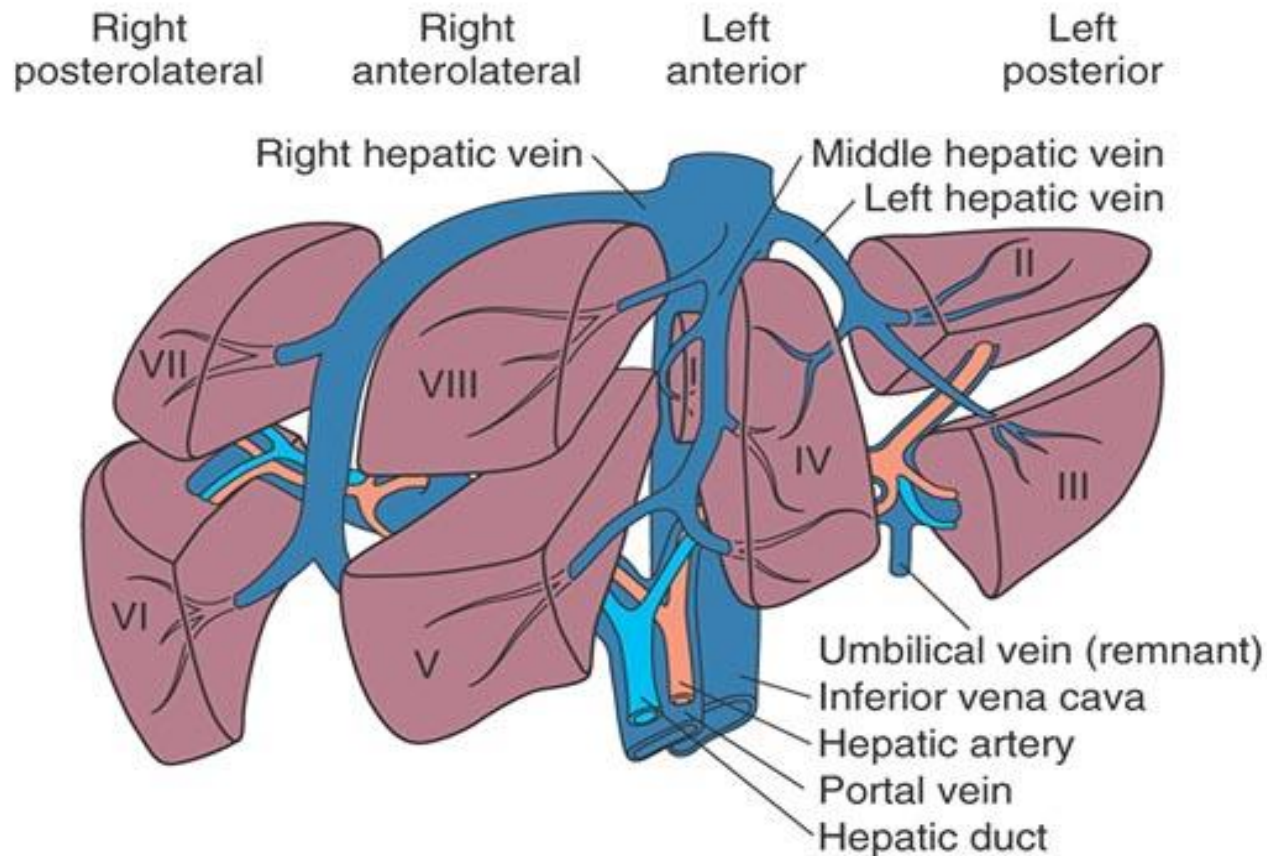




# Хирургия печени

Л.Л. Кривский

# Сегменты печени соответствуют венозному дренажу

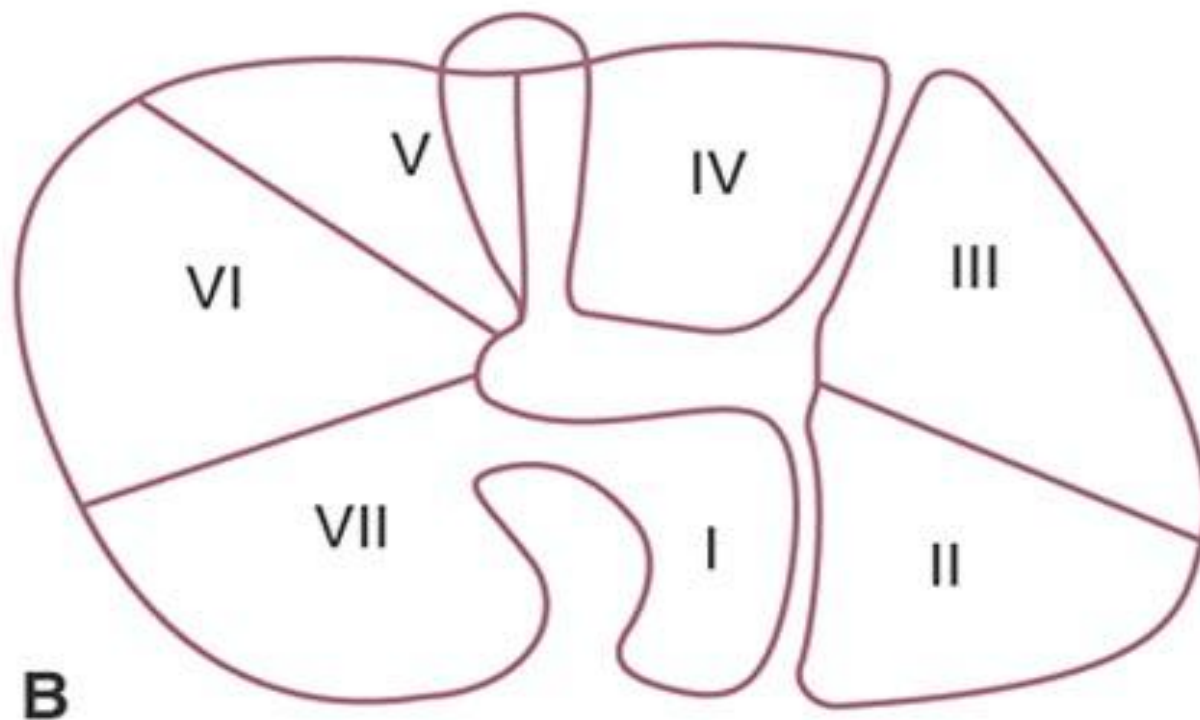


# Колоректальные метастазы

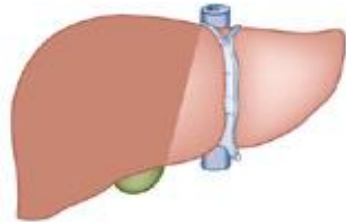


- 150,000 случаев колоректального рака в год
- У 70,000 печёночное метастазирование
- У 45,000 печень - первичный или единственный очаг
- Из них 3000 – 4500 операбельны
- В Великобритании в настоящее время проводится около 1500 резекций в год

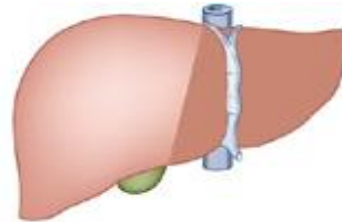
# Хирургические сегменты



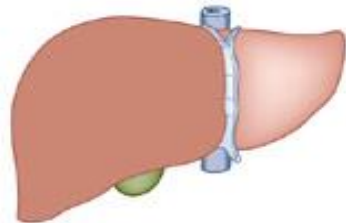
# Типы резекций печени



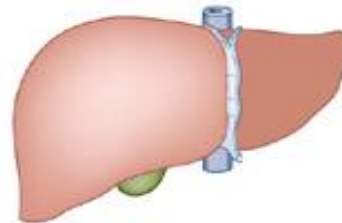
**A** Right hepatic lobectomy



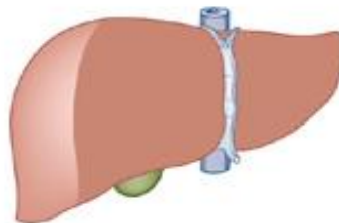
**B** Left hepatic lobectomy



**C** Extended right hepatic lobectomy



**D** Left lateral segmentectomy



**E** Extended left hepatic lobectomy

# Анестезия при резекциях печени

- Опухоли печёночных клеток
  - Гепатома
  - Саркома
- Опухоли желчных протоков
  - Холангиокарцинома
- Экстрагепатические опухоли
  - Метастазы колоректальных опухолей

# Хирургические критерии резецируемости

- Отсутствие метастазов в других органах? (кроме лёгких – удачная терапия УЗ аблацией)
- Достаточный остаточный объём? (Минимум – 0,5% веса больного)
- Возможность резекции по чётким границам?

# Неоперабельные колоректальные метастазы печени; стратегии, направленные на повышение операбельности

- Этапная химиотерапия
- Эмболизация воротной вены. 70-80% массы ткани печени регенерируют в первые 4 недели
- Этапные резекции

# Выживаемость



- 20 – 30 % без признаков рецидива через 10 лет
- Намного эффективнее любых других методов лечения в отдельности
- Операционная смертность в опытных руках – 1-3% (до 5%)
- Средняя продолжительность жизни без операции – 10 месяцев

# Факторы, влияющие на выживаемость после резекции печени

- Возраст и функциональный статус больного
- Интраоперационная кровопотеря
- Остаточная масса печёночной паренхимы



# Причины периоперационной смертности

- Острая печёночная недостаточность
- Неконтролируемое кровотечение
- Полиорганная недостаточность
- Инфаркт миокарда

# Отбор пациентов

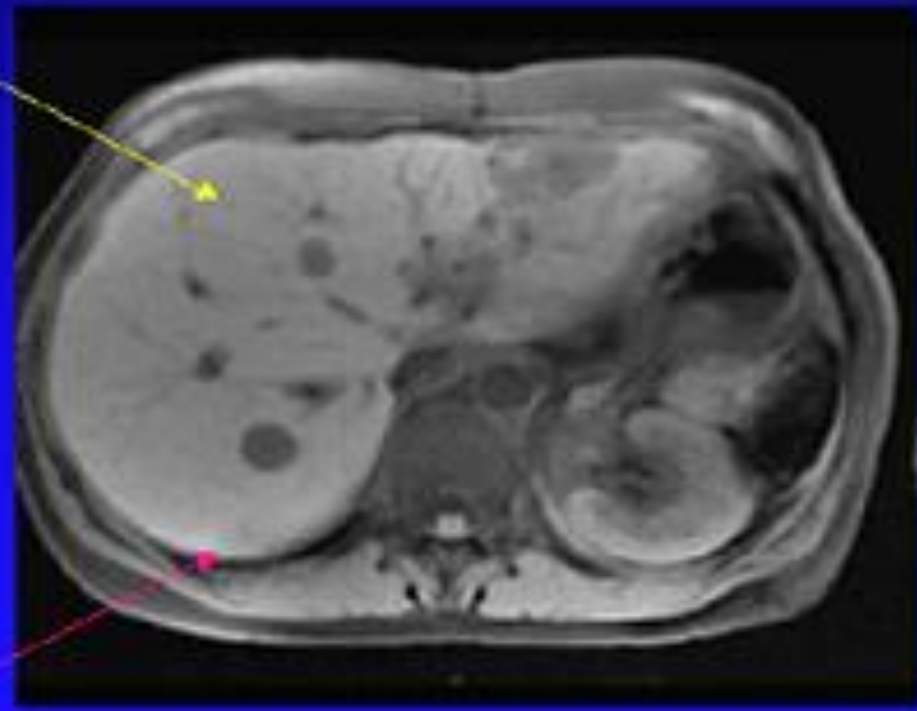
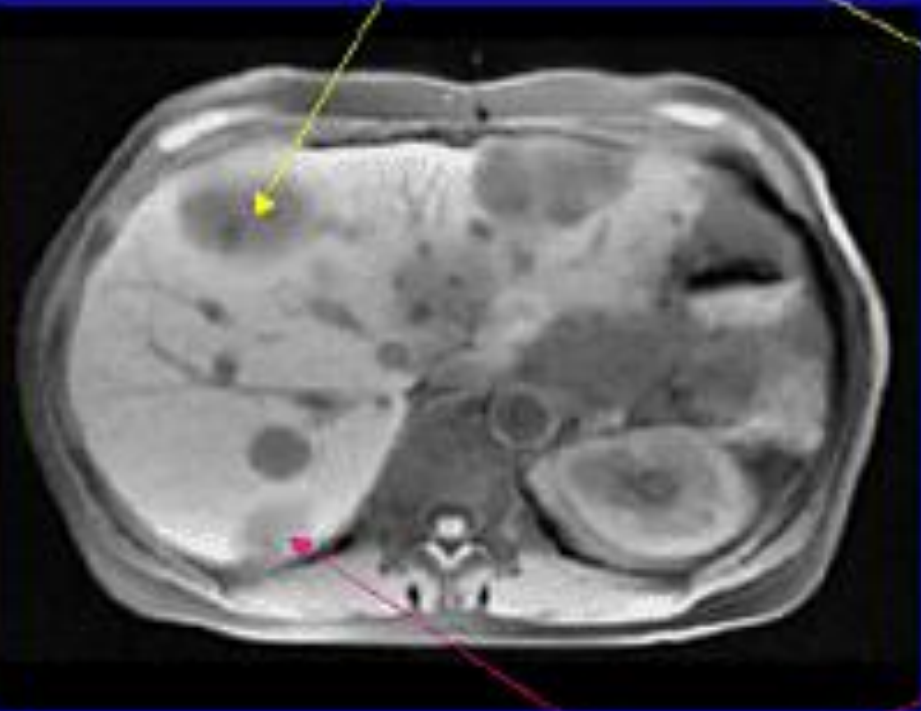


- Основная задача – детальное обследование на предмет наличия метастазов в других органах, а также исключение тяжёлой патологии сердечно-сосудистой системы и почечной недостаточности.

# Обследование больных

- КТ живота и грудной клетки ± PET сканирование
- Низкий порог для проведения (стресс)ЭХО КГ, функционального тестирования, коронарографии. Высокий риск у больных с патологией правых отделов.
- Функциональное тестирование лёгких. ABGs
- U&Es достаточны для оценки ф-ции почек.

## Regressions of GIST metastases in the Liver After only 4 weeks of STI571



# Шкала Child-Pugh

Баллы	1	2	3
Асцит	-	небольшой, или под контролем диуретиков	напряжённый
Энцефалопатия	-	лёгкой степени	значительная
Альбумин (г/л)	> 35	28-35	< 28
Билирубин (мкмоль/л)	< 34	34-50	> 50
МНО	< 1.7	1.7-2.3	> 2.3

# Операбельность



- Только больные с суммой баллов 5-6 (А) подлежат резекции печени
- В (7-9) – смертность 20-30%
- С (10-15) – неоперабельны
- В&С резекции печени не подлежат

# Индоцианин (ICG)



- Активно связывается с альбумином и экскрецируется с желчью.
- Нарушение клиренса ICG –  $>15\%$  введённой дозы определяется в плазме через 15 мин.
- Объективный функциональный тест печёночной паренхимы.

# Подготовка к индукции и мониторинг

- Минимум по AAGBI или ASA
- Инвазивное АД
- Центральная вена
- Мониторинг СВ по показаниям (пищеводный доплер, LIDCO Rapid etc)
- Центральная Т
- Назогастральный зонд
- TOF

# Закон Пуазейля и выбор в/в доступа

$$Q = \frac{\pi r^4}{8\eta L} \Delta P$$



# Проводник для Свана – 12G

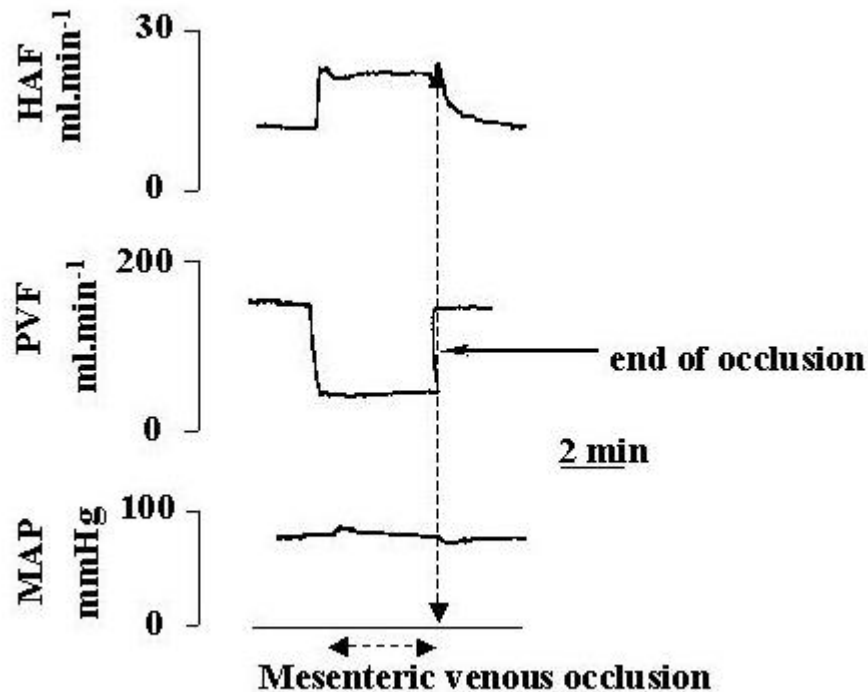


# Пособие



- В/в индукция
- Воздух/O<sub>2</sub>/Десфлюран
- ПДКВ = 0!
- +/- Торакальная эпидура
- Активное согревание больного (в/в жидкости, матрас и Bair Hugger)
- Антибиотики (бактериальная транслокация)
- Профилактика ТГВ

# Буферная реакция печёночной артерии



# Подавление буферной реакции a. hepatitis

- Halothane > Isoflurane > sevoflurane > desflurane
- Внутривенные анестетики влияния не оказывают

# Одеяло Bair Hugger



# Эпидуральная анестезия



- Лучше?
  - Уровень аналгезии
  - Общий результат лечения
- Безопаснее?
- Особенности при резекциях печени?



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## **Patient controlled intravenous opioid analgesia versus continuous epidural analgesia for pain after intra-abdominal surgery**

Werawatganon T, Charuluxananan S

### **Summary**

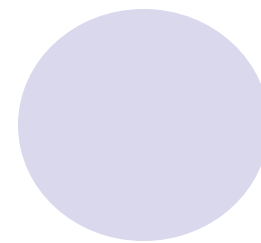
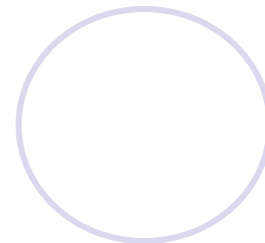
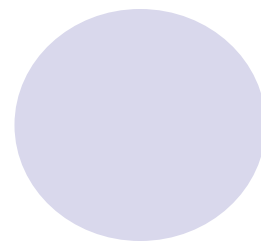
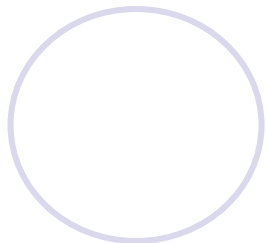
**Continuous epidural analgesia is superior to intravenous opioid patient-controlled analgesia in relieving postoperative pain for up to 72 hours after abdominal surgery**

Continuous epidural analgesia (CEA) is more effective than intravenous opioid patient-controlled analgesia (PCA) in relieving postoperative pain for up to 72 hours after abdominal surgery. CEA is associated with a higher incidence of generalized itching than PCA. There is insufficient evidence to draw comparisons about the other advantages and disadvantages of these two methods of pain relief.



[http://www.nhmrc.gov.au/publications/synopses/\\_files/cp104.pdf](http://www.nhmrc.gov.au/publications/synopses/_files/cp104.pdf)

...доказательные данные 1-го уровня: лучшее качество обезболивания при использовании эпидуральной аналгезии на торакальном уровне при операциях на верхних этажах брюшной полости...



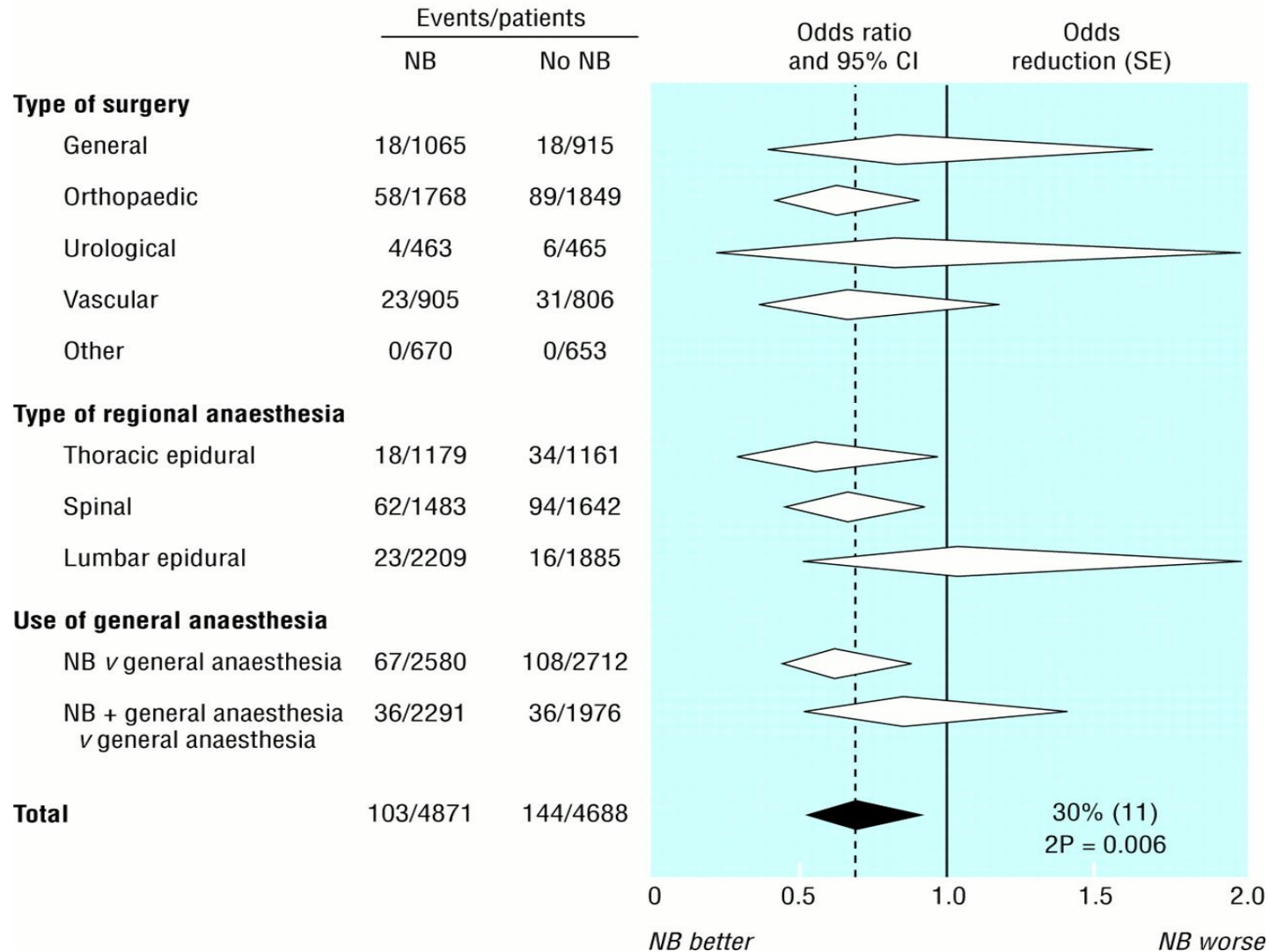
<http://www.bmj.com/cgi/reprint/321/7275/1493>

**Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials**

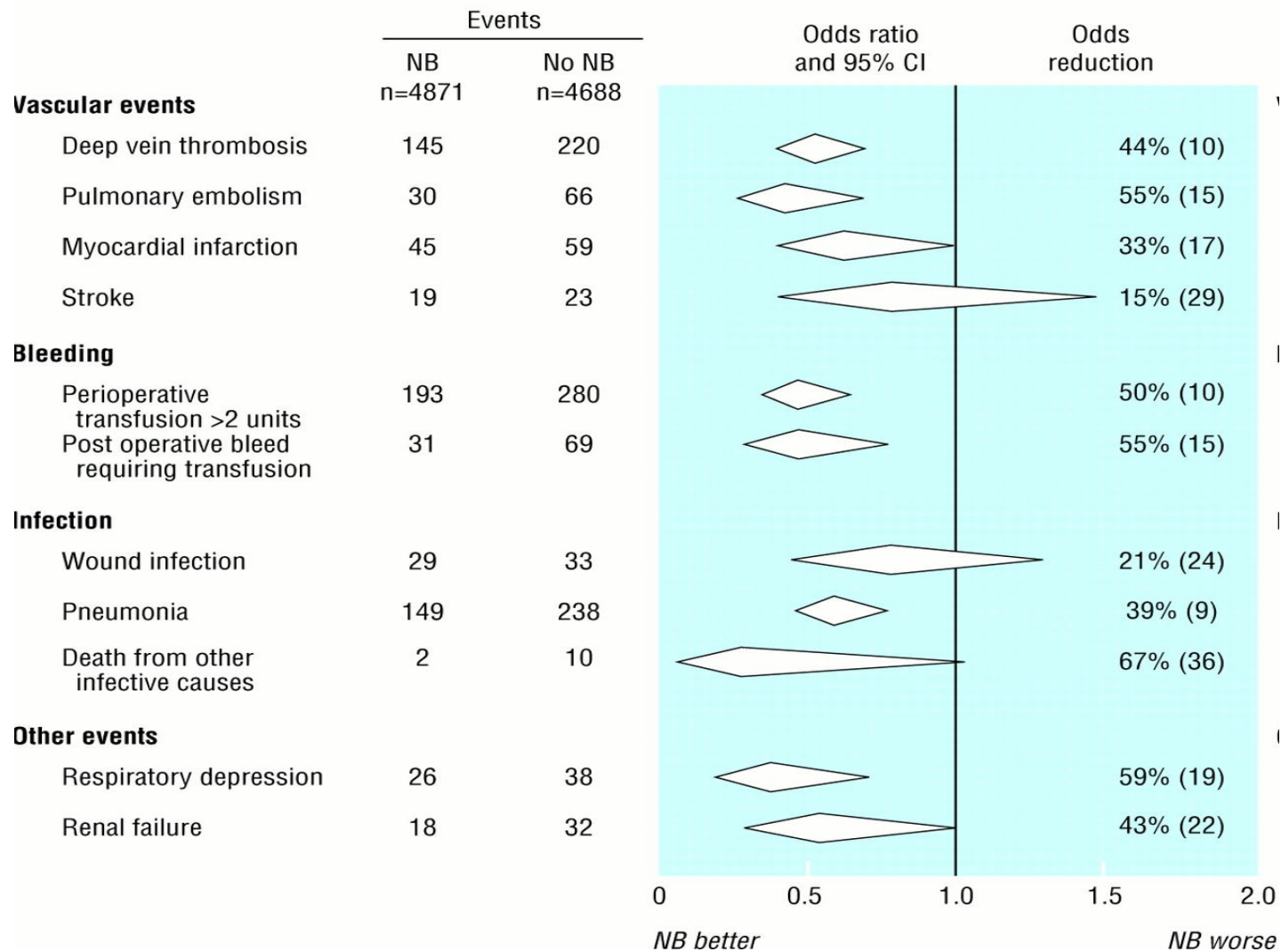
**Anthony Rodgers**, *codirector a*, **Natalie Walker**, *research fellow a*, **S Schug**, *professor b*, **A McKee**, *consultant anaesthetist c*, **H Kehlet**, *professor d*, **A van Zundert**, *consultant anaesthetist e*, **D Sage**, *consultant anaesthetist f*, **M Futter**, *consultant anaesthetist f*, **G Saville**, *consultant anaesthetist g*, **T Clark**, *statistician a*, **S MacMahon**, *professor h*.

...141 исследования; 9559 больных...

# Влияние нейроксиальной блокады на общую смертность (Rodgers et al)



# Влияние нейроаксиальной блокады на развитие п/о осложнений (Rodgers et al)



# Основная критика Rodgers



- Включение большого количества более старых исследований нейроаксиальной блокады в сосудистой хирургии и ортопедии



**The Lancet, Volume 359, Issue 9314, Pages  
1261 – 1358 (13 April 2002)**



## **MASTER Trial**

**Epidural anaesthesia and analgesia and outcome of major surgery: a randomised trial**

...включено 888 больных – эпидуральная анестезия не снижает риск большинства осложнений при операциях на брюшной полости у больных высокого риска...



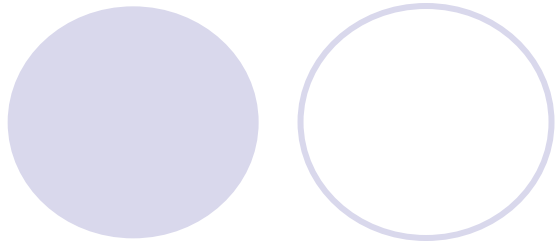
British Journal of Anaesthesia 102 (2): 179–90 (2009)



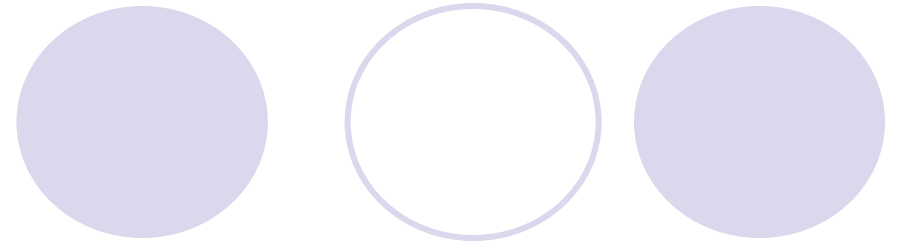
Major complications of central neuraxial block: report on the Third National Audit Project of the Royal College of Anaesthetists†

T. M. Cook, D. Counsell and J. A. W. Wildsmith on behalf of The Royal College of Anaesthetists Third National Audit Project

...все центральные нейроаксиальные блокады, проведённые в больницах Великобритании (309) за 2 недели в сентябре 2006 г 25 = 707425. Перманентное неврологическое повреждение – 4.2/100000; параплегия или смерть – 1.8/100000...



?





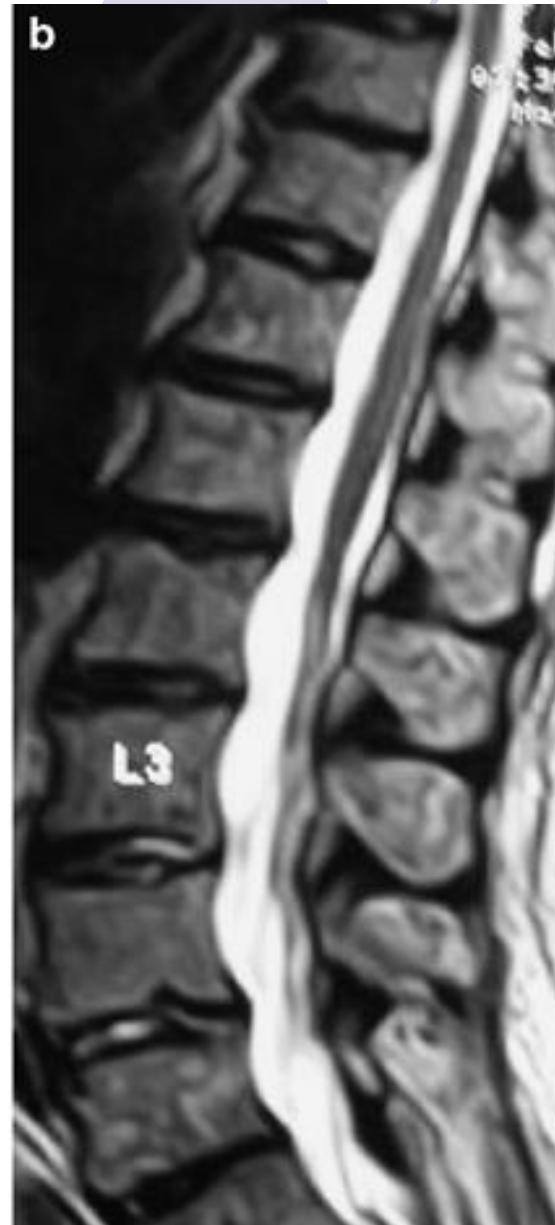
**НО**, каких-либо исследований, прицельно изучающих влияние эпидуральной анестезии на исходы при операциях на печени, не существует.

# Противопоказания к эпидуральной анестезии при резекциях печени

- Портальная гипертензия
- МНО > 1,5 (1,4)
- Тромбоциты < 100000
- Клопидогрель < 7 дней

# Коагулопатия при болезнях печени

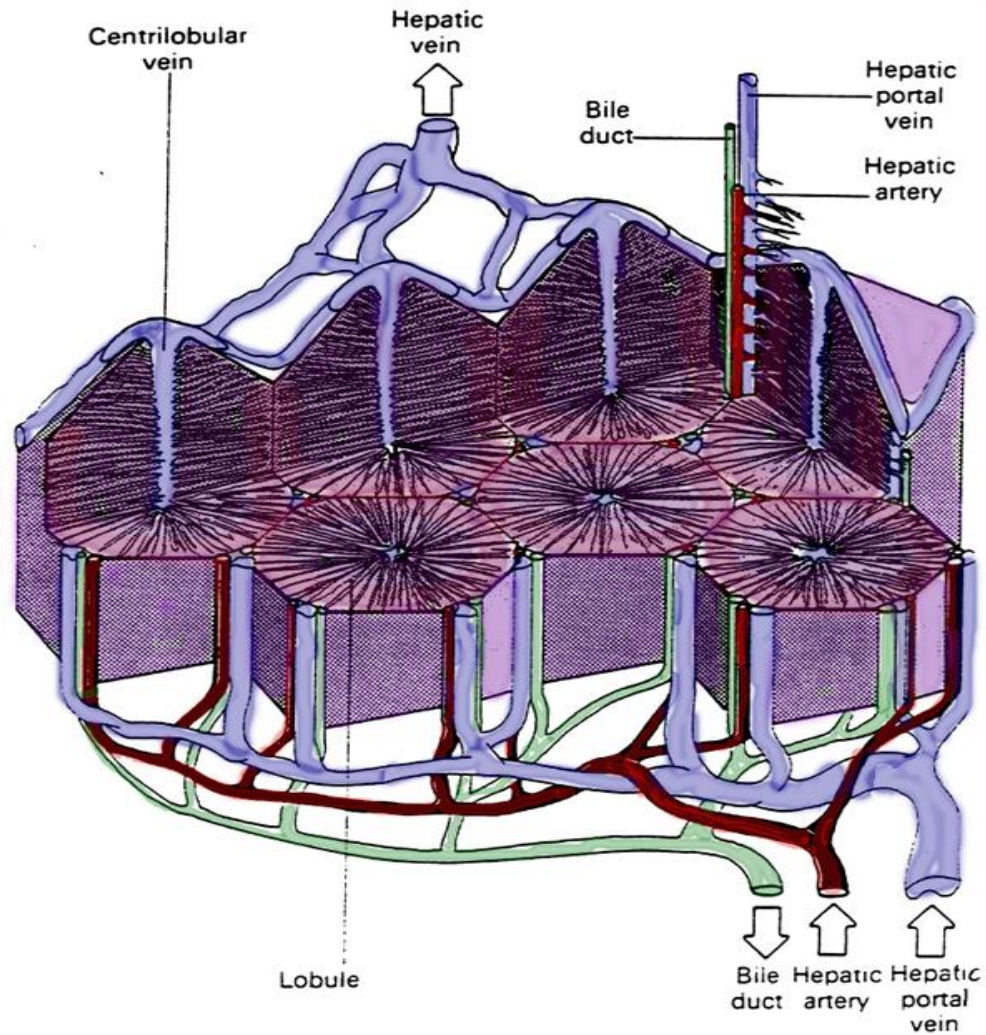
- Снижение синтеза факторов свёртывания и ингибиторов
- Сокращение количества тромбоцитов и нарушение их функции
- Гиперфибринолиз



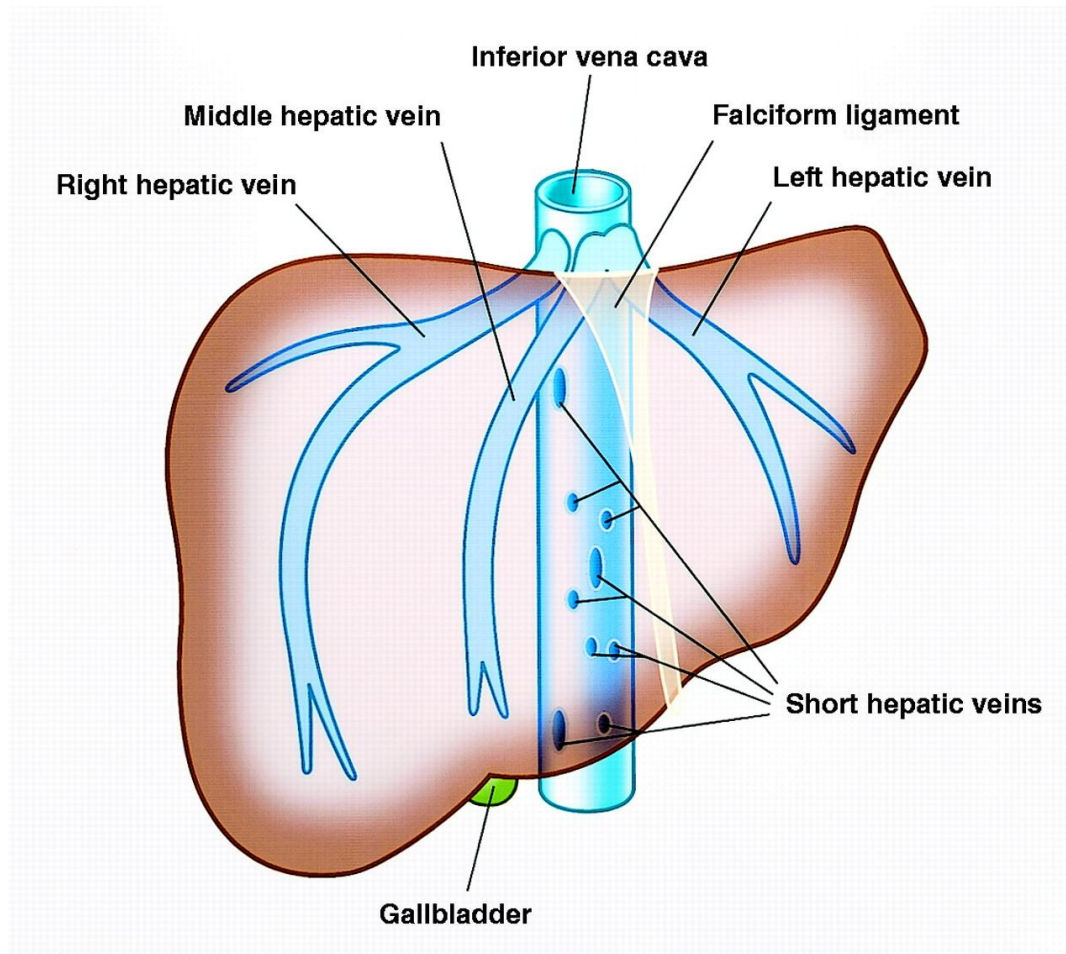
# Методы снижения кровопотери

- Контроль ЦВД
- Cell-salvage
- Использование антифибринолитиков
- Использование CUSA

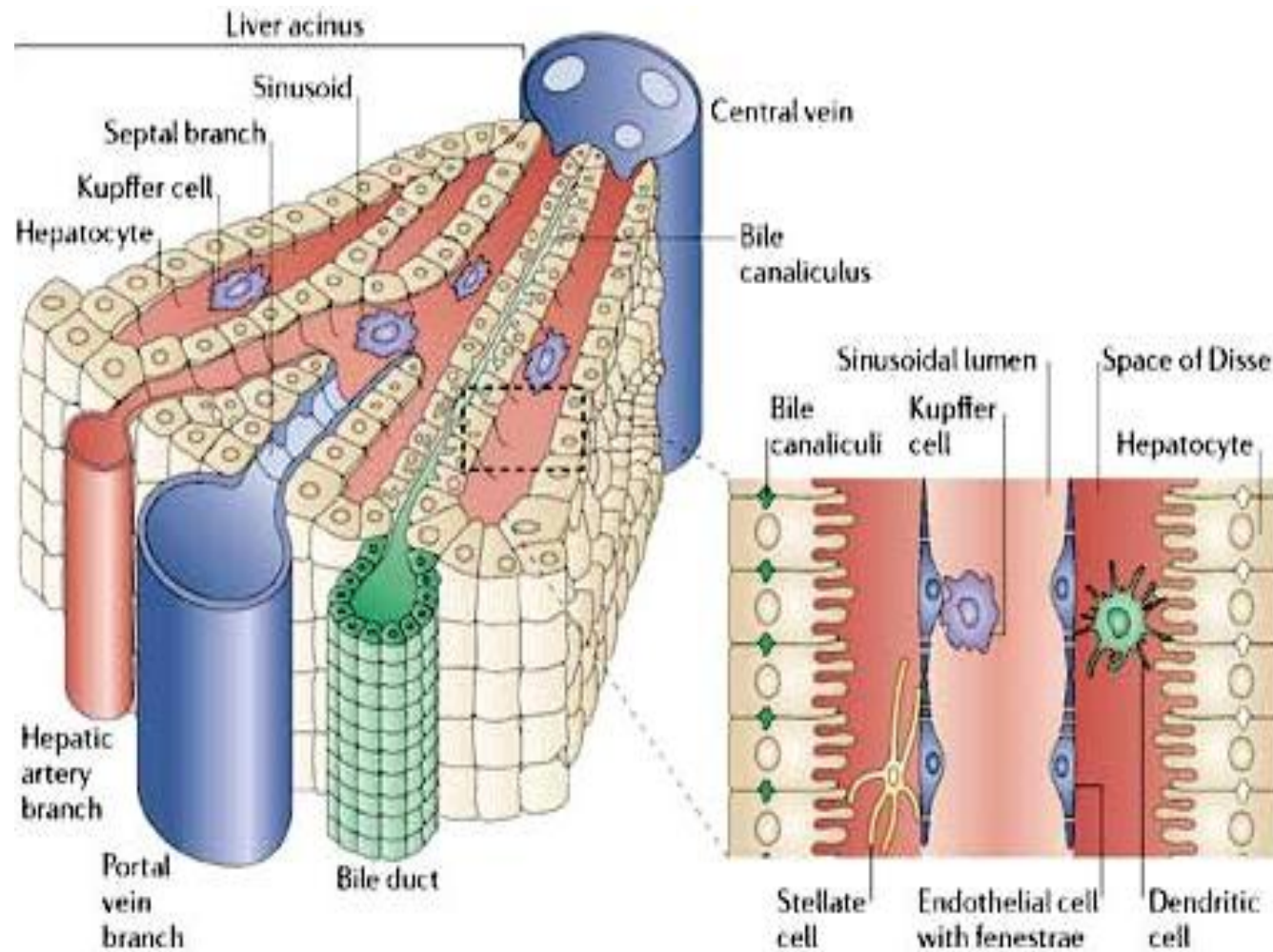
# Кровоснабжение печени



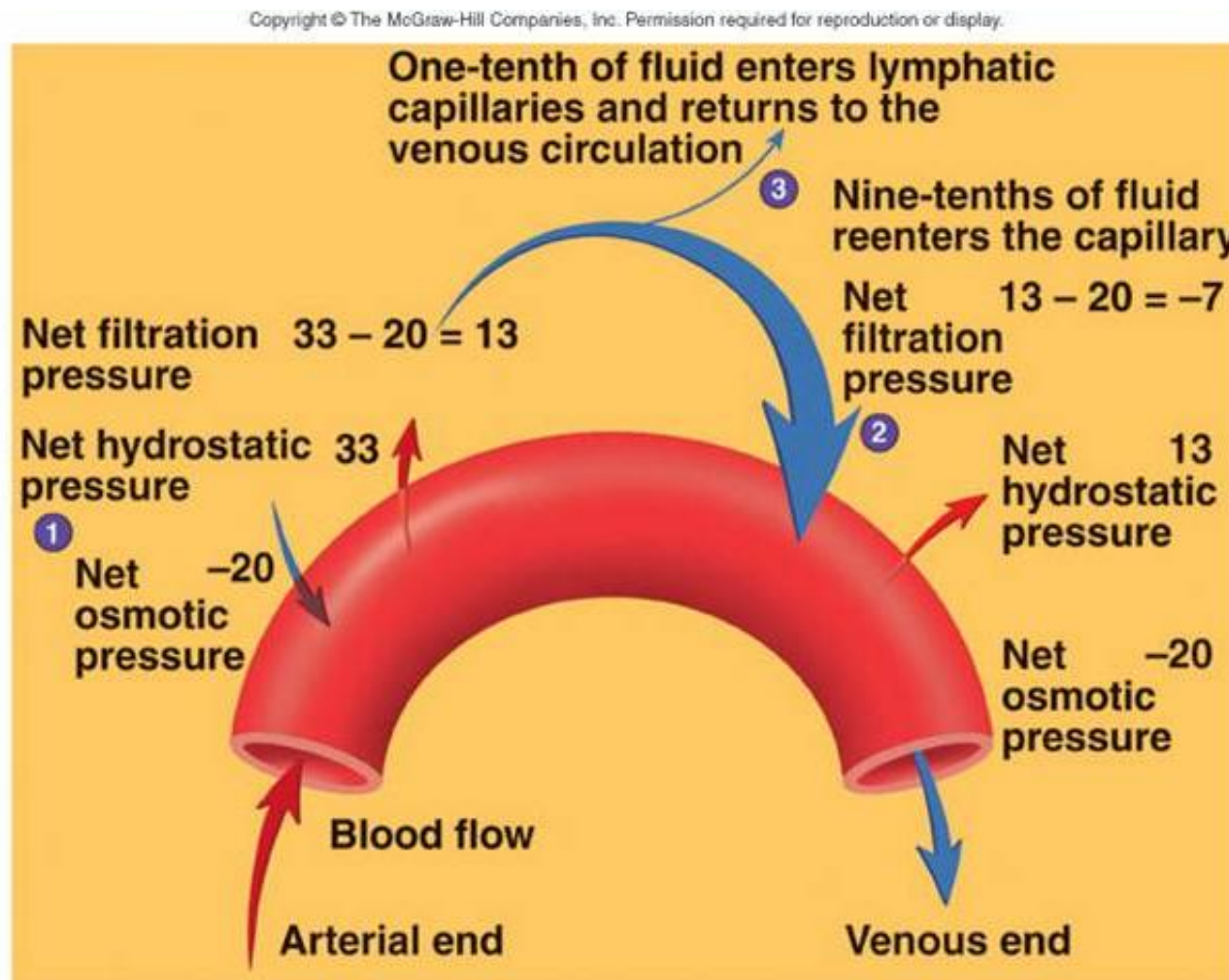
$P_{vv}$  hepatis = ЦВД



# Организация дольки печени



Силы Старлинга, действующие в обычных капиллярах, в синусоидах печени отсутствуют = нарастание отёка паренхимы при повышении ЦВД



# Venous pressure elevation



- The hepatic veins drain into the IVC at the level of the diaphragm
- HV pressure is RA pressure
- High RA pressure causes more bleeding (in a non cirrhotic liver)
- Also rapid formation of hepatic oedema, increased lymphatic flow and formation of ascites

# Anaesthetic requirements



- Low hepatic vein pressures
- Possible minor reduction in splanchnic blood flows
- Aim to preserve liver function

# Risks



- Hypovolaemic technique constitutes additional risk in event of major bleed
- Air embolus is constant danger
- Potential postoperative renal and hepatic failure if pre-existing function poor.

# Effects of resection



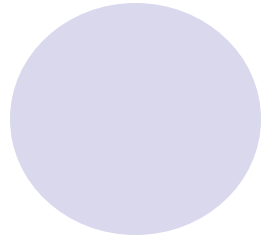
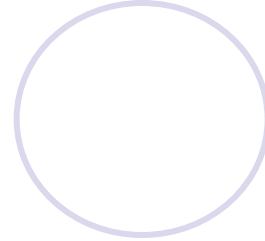
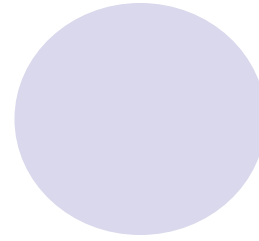
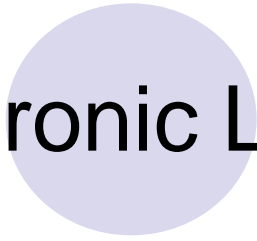
- Loss of cellular mass and therefore hepatocyte functions
- Compromise of GI / circulatory barrier (Kupffer cells)
- Haemorrhage; venous back bleeding, coagulopathy
- Effects of Pringle manoeuvre; ischemia, reperfusion. Can precipitate fibrinolysis

# Summary



- Anaesthesia can modulate liver oxygen supply and demand
- Can compromise liver blood flow
- Surgery can compromise both liver blood supply and metabolic and RE functions of the liver
- Good outcomes in liver surgery have become the norm

Chronic Liver Disease



Caroline Marshall

Consultant Anaesthetist SUHT

# Organs affected by cirrhosis



- Cardiovascular system
- lungs
- kidneys
- coagulation
- brain
- portal circulation
- gut/ nutrition/ immune competence

# CVS changes



- Increased CO
- Decreased SVR
- Increased circulating volume
- Cirrhotic cardiomyopathy
- Portopulmonary hypertension

# Cardiac Disease in Cirrhotics



- High prevalence of CAD amongst cirrhotics being worked up for transplantation
- 26% had moderate to severe coronary narrowing
- Right and left sided filling pressures were elevated suggesting abnormalities in LV diastolic compliance

# Lungs

A decorative graphic at the top of the slide consists of two groups of circles. The first group on the left has a solid light purple circle on the left and an outlined light purple circle on the right. The second group on the right has a solid light purple circle on the left, an outlined light purple circle in the middle, and a solid light purple circle on the right.

- Pleural effusions
- Basal atelectasis
- Hepatopulmonary syndrome (intrapulmonary shunts)
- Emphysema
- Bronchiectasis (PSC)

# Kidneys



- Dehydration due to diuretics, ascites and hypoalbuminemia
- reduced perfusion pressure from ascites
- endotoxaemia
- hepatorenal syndrome

# Coagulopathy



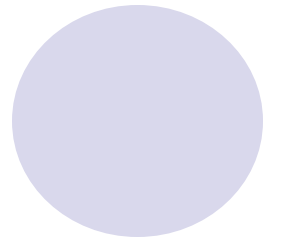
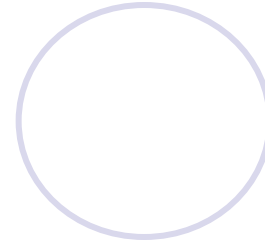
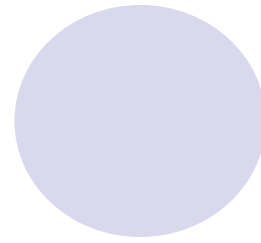
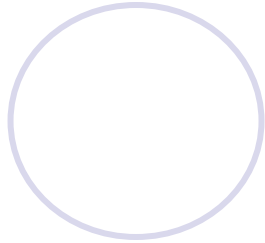
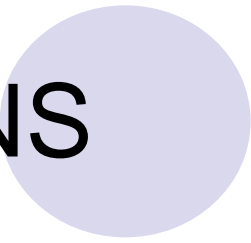
- Fibrinolysis
- decreased synthesis of clotting factors
- synthesis of abnormal factors
- thrombocytopenia
- endogenous heparin release
- endotoxaemia



# Immunity

- Poor Kupffer cell function
- abnormal liver architecture and circulation
- malnourished
- reduced biliary IgA
- Endotoxin accesses systemic circulation

CNS



- Encephalopathy (PSE) reversible
- cerebral atrophy
- alcoholic brain damage

# Metabolic



- Relative dehydration
- TBV increased by 20%
- low sodium, magnesium and albumin
- usually acidaemic
- urea and creatinine may be normal or low even in incipient renal failure (GFR 20ml/min)

# Lactate metabolism



- Uptake; transporter saturated at 2 mmol/l then 1st order kinetics
- main disposal pathway is gluconeogenesis; inhibited by intracellular acidosis
- lactate metabolism significantly impaired when liver blood flow falls below 25% of normal

# Gut



- Oesophageal varices
- delayed gastric emptying (in theory)
- peptic ulceration
- malabsorption

# Liver decompensation in chronic liver disease

- Portal hypertension; varices; bleeding; shunts; ascites
- Renal failure
- Hypersplenism
- Porto-systemic encephalopathy
- Cognitive impairment;



# Porto-systemic encephalopathy

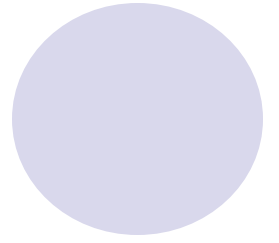
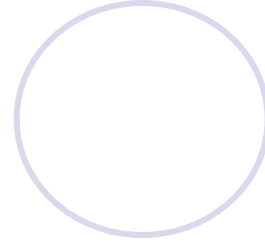
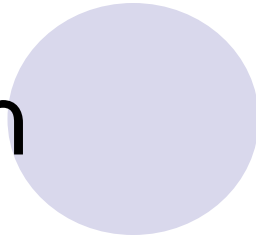
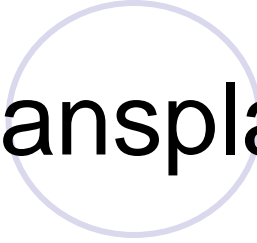
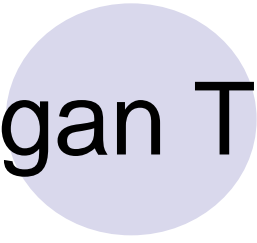
- Exacerbated by bleeding, dehydration, protein load, sepsis, constipation, alkalosis and surgical shunts
- cerebral oedema extremely rare
- patients don't die from PSE as long as supported by airway management etc
- fully reversible

# Clinical problems



- Variceal haemorrhage; procedures include balloon tamponade, sclerotherapy, portosystemic shunts, TIPSS
- ascites; procedures include drainage, Le Veen shunts, (fluid overload) and porto systemic shunts (portosystemic encephalopathy)

# Organ Transplantation



# Ethics of transplantation



- Organ procurement
- Brain stem death (UK mid 1970's)
- Japan 1997
- Anencephalic donors- poor results
- Elective ventilation 1988
- Non heart beating donors
- Living donors (related and unrelated)

# Consent

A decorative graphic at the top of the slide consists of a row of six circles. The first circle is solid light purple and contains the word 'Consent'. The second circle is hollow with a light purple outline. The third circle is solid light purple. The fourth circle is hollow with a light purple outline. The fifth circle is solid light purple. The sixth circle is solid light purple.

- Opt in (UK)
- Opt out
- Consent from relatives
- Required request
- Conditional donation; DOH review
- Rewards for donation
- Allocation controlled by UK transplant



# Legislation and Regulation

- 1961 Human Tissue Act and 1989 Human Organ Transplants Act in UK
- HTA: person in lawful possession of body can authorize organ removal
- HOT: permits anyone suitable to donate organ or part of organ to blood relative
- Unrelated live transplant regulatory authority (ULTRA) was set up under this act to approve non blood relative donations to ensure no payments and no coercion

# Update to Legislation



- Human Tissue Act 2004; became law 1<sup>st</sup> September 2006
- Removes right of relatives to overrule the wishes of a (deceased) relative to donate organs
- Currently 1 in 10 people who have registered to donate are overruled by their relatives



# Maximizing transplant rates

- Live Donation, related and unrelated
- “first do no harm” principle violated
- very important to minimize morbidity including pain.
- Non heart beating donation
- Domino transplants (requires ULTRA approval)
- Xenotransplantation (UKXIRA) moratorium at present
- Cell infusions (pancreas and liver) limited applicability

# Statistics:

UK Transplant 1/4/2005 - 31/3/2006

- Organs retrieved from 756 people
- 2,196 people received transplants
- 126 non heart-beating donors (up 43%)
- 1,799 renal transplants (33%) live related
- 586 livers
- 262 cardiothoracic (9% decrease)
- 6700 on the active waiting list (9% increase)

# Suitability for organ donation in case of brain stem death- exclusion criteria

- Cancer except primary CNS
- HBsAg or HIV positive
- High risk of HIV infection
- Severe sepsis/ MOF
- Severe systemic disease
- Slow virus infection/ active TB

# Suitability for organ donation in cases of BSD

- Kidneys age 4-70 reasonable creat and urea
- Heart age 0-50 normal CXR and ECG
- Lungs age 0-50 normal CXR and blood gases
- Liver age 0-55 no alcohol/drug abuse. OK  
LFTs
- Corneas age 0-90, no ocular surgery



# Care of donor- anaesthetic management

- Anaesthetic support will be from donor hospital
- Visiting surgical teams (may be multiple)
- Discuss requirements prior to harvesting
- Major thoraco-abdominal procedure, unstable patient, median sternotomy labile bp
- Continue ITU management
- Frusemide, mannitol, chlorpromazine may be requested

# Care of donor organ



- Kidney can be retrieved up to 1 hour post mortem, corneas up to 24 hours
- All others should be retrieved from beating heart donor
- Cold ischeamic time: heart 4 hours; liver 12-24 hours; kidney up to 48 hours



# Matching organ with recipient

- Kidney/pancreas - HLA compatibility
- Liver/heart/ kidney – ABO compatibility
- Liver – physical match
- Recipient factors; urgency, time on waiting list,

# Principles of Transplantation and Immunosuppression



- Immunosuppression is dangerous:
- 3 main side effects of current nonspecific immunosuppression are Tumours, Infection and Cardiovascular disease
- Immunosuppressant drugs have side effects
- newer agents enable a tailored approach depending on age, glucose handling, lipid profile etc
- Only transplant essential organs

# Mechanism of Rejection



- Organ transplants are allogenic
- Foreign proteins rejected but occasionally long term tolerance develops
- Cellular response-activation of helper T cells
- Humoral response- lymphocytes proliferate and create antibodies

# Infectious Complications



- During 1st month after graft usual organisms predominate
- Month 2-6 opportunistic viral and fungal infections predominate
- Thereafter bacterial infections, slow developing fungal and mycobacterial infections predominate

# Tumours



- Particularly cancers with a putative viral origin: non-Hodgkins lymphoma, squamous cell Ca of skin, Kaposi's sarcoma and cervical cancer
- Also increased risk for all cancers
- Surveillance and advice is integral part of post transplant management



# Cardiovascular disease

- Aggressive atheromatous disease often occurs
- Usually associated with hypertension and hyperlipidemia (side effects of many immunosuppressive drugs)
- *May* be consequence of immunosuppression per se

# Anaesthesia for heart recipients

- 25% need general surgery within 2 years
- cholecystectomy, perforated viscus, orthopaedics
- Coronary artery disease is common- presents as heart failure or new arrhythmias. 30% of recipients have multivessel disease within 3 years
- Assess LV contractility by echo
- preload dependent, denervated allograft
- CO alters by change in change in SV
- HR response slow, then prolonged
- must have adequate central volume

# Heart recipients



- ECG may have 2 P waves
- indirect drugs, atropine, pancuronium don't increase heart rate; ephedrine and b-blockers will have effects
- Pure vasoconstrictors may be used to correct hypotension
- Use spinals and epidurals with caution
- Peripheral blocks are ideal
- arrhythmias and low CO are signs of rejection as well as ischaemia

# Lung recipients



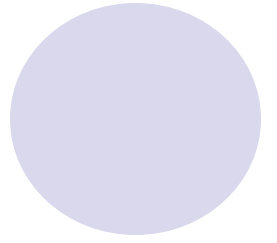
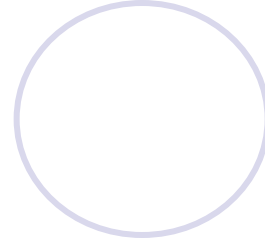
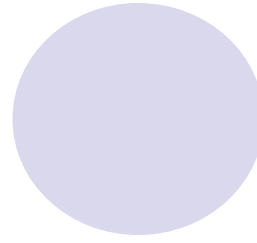
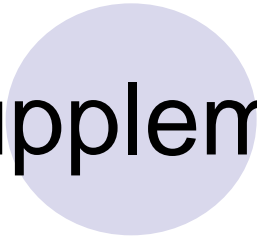
- Expect some limitation-manage as other COPD patients
- Denervated trachea- reduces cough reflex distal to tracheal or bronchial anastomosis
- Single lung recipients may suffer from differential compliance or V/Q mismatch during anaesthesia
- Usually overcome by increasing FiO<sub>2</sub> and Peep
- Occasionally lung isolation and differential ventilation are needed to avoid barotrauma
- **MAINTAIN IMMUNOSUPPRESSION** converting to intra-venous if needed. Take advice from Tx centre

# Liver recipients



- Few anaesthetic problems with good graft function
- Scale of procedure makes intra-abdominal surgery very tricky
- Decompensated recipients are major challenge!

Supplementary slides



# Common drugs and main side effects

- Corticosteroids

- Calcineurin blockers

*Cyclosporin*

- Antiproliferatives

*Azothiaprine*

Antilymphocyte antibodies

*OKT3*

- Glucose Intolerance

- Hypertension

- HT, nephrotoxicity

- Hepatotoxicity

- Blood dyscrasias

- GI upset

- Fever, serum sickness

# Kidney recipients



- Diabetes, HT and IHD may coexist
- May have mild to moderate renal impairment
- Avoid prolonged preoperative dehydration
- Atracurium is most predictable relaxant but even this may be prolonged with cyclosporin and acidosis
- Careful with veins and arteries
- Careful with position of heterograft
- Avoid NSAIDS, gentamycin and dehydration



# Tacrolimus

- Macrolide antibiotic
- Similar mechanism of action to cyclosporin
- 100 times more potent
- Side effects similar especially renal. Never prescribe NSAIDs for patient on tacrolimus

# Azathioprine



- Purine analogue
- Inhibits DNA and RNA synthesis
- Therefore inhibits T and B cell proliferation
- Bone marrow suppression
- Hepatotoxicity
- High cell turnover (skin, GI) organs hit
- Increases non-depolarizing relaxant requirements

# Cyclosporin



- Derived from soil fungus
- Inhibits activated macrophages from producing IL-1
- Inhibits T lymphocytes from producing IL-2
- Blocks activation of helper T lymphocytes
- Nephrotoxicity, hypertension, hepatotoxicity, gingival hypertrophy

# Mycophenolate mofetil



- New immunosuppressant
- Antiproliferative (especially T and B cells)
- Inhibits a single enzyme in DNA synthesis and may be less mutagenic(no effect on DNA repair)
- GI and haematological side effects
- **NOT** nephrotoxic!

# Antibodies (poly and monoclonal)

- ALG derived from animals immunized with human lymphocytes
- After injection attaches to circulating lymphocytes and lyses them
- Monoclonals have less toxicity but may cause flu like illness, bronchospasm or CVS instability on first use
- OKT3 binds to receptor on T cells blocking recognition of MHC antigens of foreign cells