



Teaching Module II

Acute non-renal reactions to iodinated
and Gd-based CM plus US-agents





Acute non-renal reactions to Iodinated and Gd-based CM

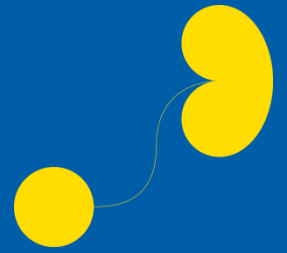
This slide deck was prepared by

Henrik S. Thomsen

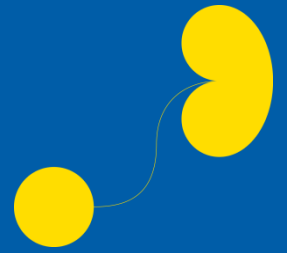
Director & Professor, Department of Diagnostic Sciences,
Faculty of Health Sciences, University of Copenhagen, Denmark
& Consultant, Department of Diagnostic Radiology,
University of Copenhagen Herlev Hospital,
Herlev, Denmark

The ideal contrast medium

It must be totally inert.



The ideal contrast medium

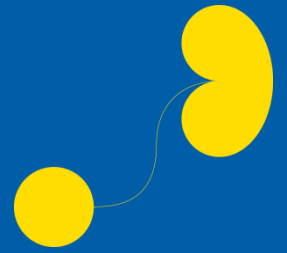


It must be totally inert.

It may not have any interaction with the organism at any level.



The ideal contrast medium



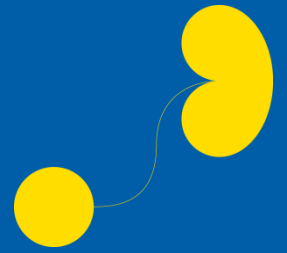
It must be totally inert.

It may not have any interaction with the organism at any level.

It must be excreted fast and completely.



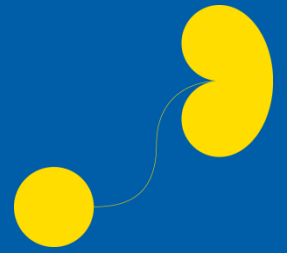
The ideal contrast medium



It does not exist.



Adverse reactions

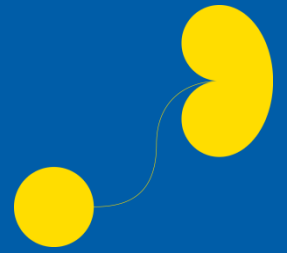


Acute

Non-acute



Adverse reactions

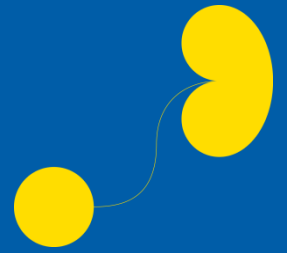


Acute < 60 min after exposure

Non-acute > 60 min after exposure



Adverse reactions



Acute < 60 min after exposure

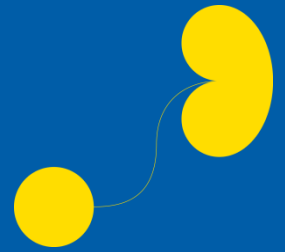
- Renal, e.g. CIN
- Non-renal, e.g. anaphylactoid reactions

Non-acute > 60 min after exposure

- Late: 60 min – 7 days after exposure, e.g. skin rash
- Very late: > 7 days after exposure, e.g. NSF



Non-renal acute adverse reactions



Mild

- Nausea, mild vomiting
- Urticaria
- Itching

Moderate

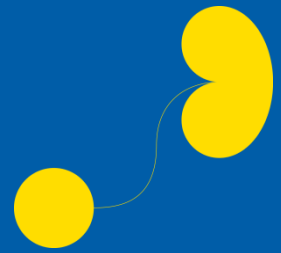
- Severe vomiting
- Marked urticaria
- Bronchospasm
- Facial/laryngeal edema
- Vasovagal attack

Severe

- Hypotensive shock
- Respiratory arrest
- Cardiac arrest
- Convulsion



Non-renal acute adverse reactions



Mild

- Nausea, mild vomiting
- Urticaria
- Itching

Moderate

- Severe vomiting
- Marked urticaria
- Bronchospasm
- Facial/laryngeal edema
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Severe

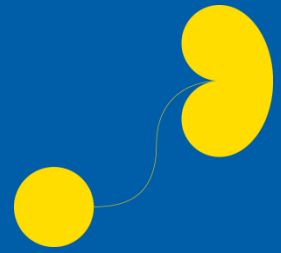
- Hypotensive shock
- Respiratory arrest
- Cardiac arrest
- Convulsion

The same for all agents

Requires treatment



Non-renal acute adverse reactions



Mild

- -
- 1-15%
- -

Moderate

- -
- 0.2-0.4%
- -
- -
- -

Severe

- -
- < 0.01%
- -
- -

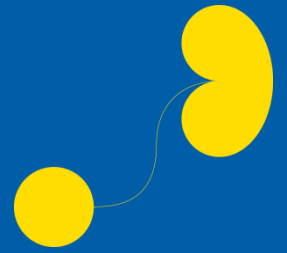
Figures for non-ionic Iodine based agents



Requires treatment



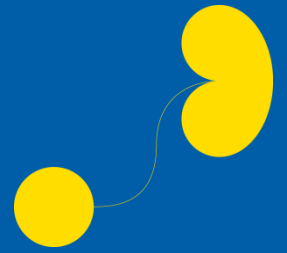
Incidence of acute reactions to ICM



| | HOCM | LOCM |
|----------|-------------|---------------|
| Mild | 5 - 15% | 1 - 3% |
| Moderate | 2% | 0.2% |
| Severe | 0.2 - 0.04% | 0.04 - 0.004% |



Incidence of acute reactions to ICM

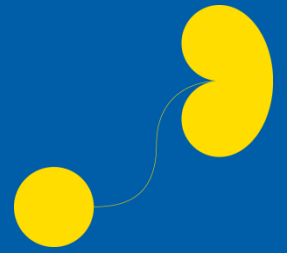


| | HOCM | LOCM |
|-----------|-------------|-------------|
| Mortality | 1 : 170,000 | 1 : 170,000 |

Katayama et al., Radiology 1990; 175:621-628



Non-renal acute adverse reactions



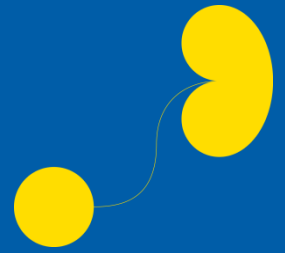
Iodine based agents > Gadolinium based agents > US-agents

No difference in the prevalence of acute adverse reactions amongst the various non-ionic iodine based agents

No difference in the prevalence of acute adverse reactions amongst the various gadolinium based agents



Risk factors for non-renal acute adverse reactions



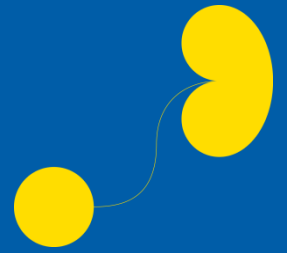
Patient-related

Patient with a history of:

- Previous moderate or severe acute reaction
- Asthma
- Allergy requiring medical treatment



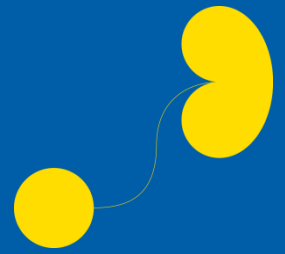
Incidence of severe reactions



| | | |
|---------------------------------------------|---|------|
| History of allergy | X | 3 |
| History of previous adverse reactions to CM | X | 5 |
| History of bronchial asthma | X | 6-10 |



Risk factors for non-renal acute adverse reactions



Patient-related

Patient with a history of:

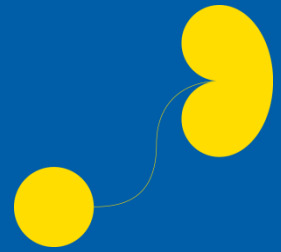
- Previous moderate or severe acute reaction
- Asthma
- Allergy requiring medical treatment

Contrast-medium-related

High-osmolar ionic iodine-based contrast medium



Acute adverse reactions

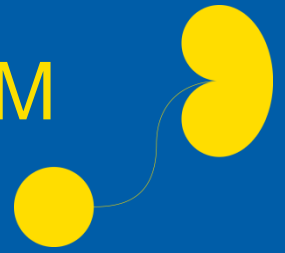


| | Low-osmolar I-CM | Gd-CM |
|----------------------|------------------|-----------|
| Number of injections | 298,491 | 158,439 |
| Adverse reactions | 0.15% | 0.04% |
| Mild | 374 (81.6) | 49 (76.6) |
| Moderate | 69 (15.1) | 11 (17.2) |
| Severe | 15 (3.3) | 4 (6.3) |
| Needing treatment | 79 | 15 |

Hunt et al., AJR 2009; 193(4):1124-7



Risk factors for acute reactions with Gd-CM

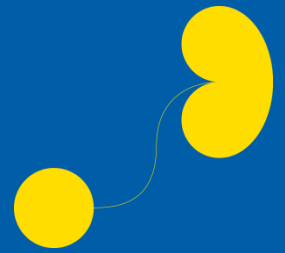


- Previous moderate or severe reaction to CM (ICM or Gd-CM)
- Asthma
- Allergy requiring medical treatment

Acute reactions increase by a factor of 3-4



To reduce the risk of a non-renal acute adverse reaction

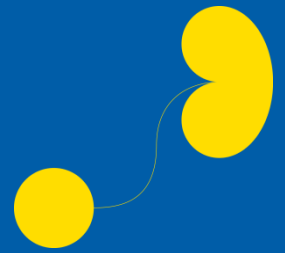


For all patients

- Use a non-ionic iodine-based contrast medium for X-ray.
- Keep the patient in the Radiology Department for 30 min after contrast medium injection.
- Have the drugs and equipment for resuscitation readily available.



To reduce the risk of a non-renal acute adverse reaction

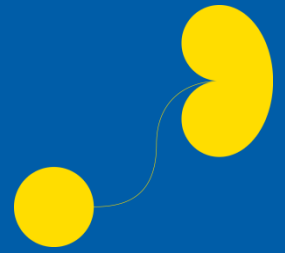


For patients at increased risk of a reaction

- Consider an alternative test not requiring an iodinated contrast agent.
- Use a different iodinated agent for previous reactors to contrast medium.
- Consider the use of premedication. However, clinical evidence of the effectiveness of premedication is limited.



Premedication (opinions are divided)

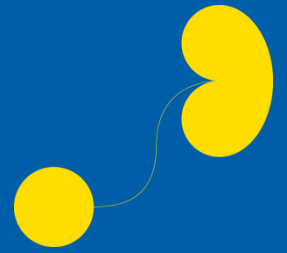


Corticosteroids

- Prednisolone 30 mg orally or methylprednisolone 32 mg orally 12 and 2 hours before contrast medium.
- Corticosteroids are not effective if given less than 6 hours before contrast medium.

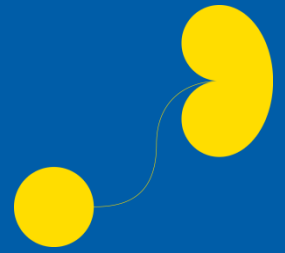
Antihistamines H1 and H2 may be used in addition to corticosteroids, but opinions are divided.





The brief administration of steroids is relatively safe and inexpensive but should be avoided in patients with diabetes mellitus, active tuberculosis and in the presence of systemic infection.

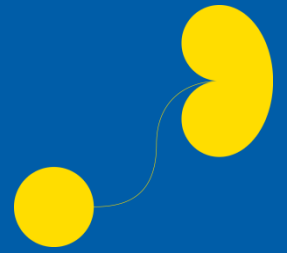




Severe, even life-threatening reactions may still occur in patients who receive both corticosteroid premedication and low-osmolar contrast media.



Steroids



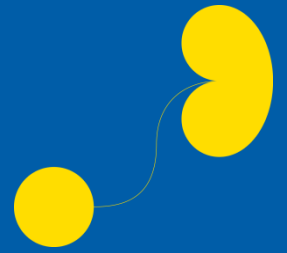
Katayama et al.

No beneficial effect of steroid premedication before non-ionic LO.

But it was given immediately before the contrast medium.



Steroids

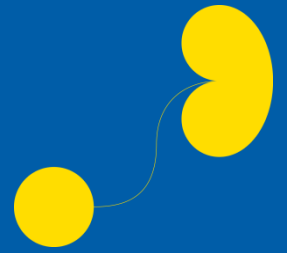


UK-survey

Only 55% of responders use corticosteroids.



Steroids



UK-survey

Only 55% of responders use corticosteroids =
45% do not pretreat



Steroids

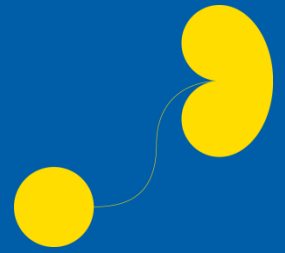
UK-survey

Only 55% of responders use steroids
45% do not pretreat

ESUR – survey
Clear tendency: Northern
Europeans do not pretreat,
whereas in Southern
Europe it is a routine.



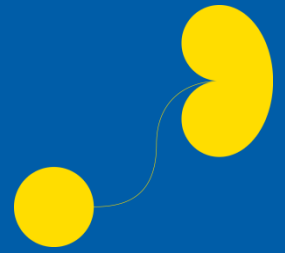
Despite preventive measures



- 8 patients out of 78,353 experienced 9 allergic-like reactions after IV administration of Gd-CA, despite premedication.



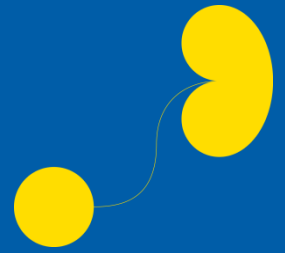
Despite preventive measures



- 8 patients out of 78,353 experienced 9 allergic-like reactions after IV administration of Gd-CA, despite premedication.
- 1 patient had 2 breakthrough reactions.



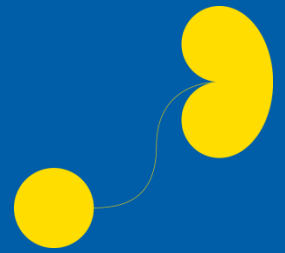
Despite preventive measures



- Eight patients out of 78,353 experienced 9 allergic-like reactions after IV administration of Gd-CA, despite premedication.
- A single patient had 2 breakthrough reactions.
- 6 breakthrough reactions were mild, and 3 were moderate.



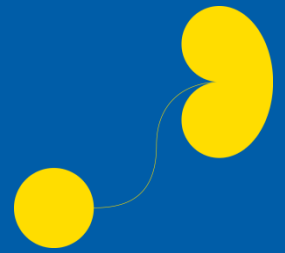
Despite preventive measures



- Eight patients out of 78,353 experienced 9 allergic-like reactions after IV administration of Gd-CA, despite premedication.
- A single patient had 2 breakthrough reactions.
- Six breakthrough reactions were mild, and 3 were moderate.
- No severe or fatal breakthrough reactions occurred.



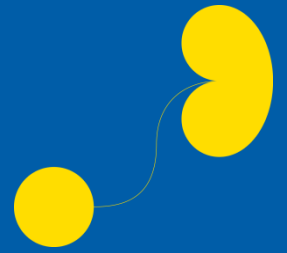
Despite preventive measures



- Eight patients out of 78,353 experienced 9 allergic-like reactions after IV administration of Gd-CA, despite premedication.
- A single patient had 2 breakthrough reactions.
- Six breakthrough reactions were mild, and 3 were moderate.
- No severe or fatal breakthrough reactions occurred.
- 8 of 9 breakthrough reactions occurred in adults.



Prevention

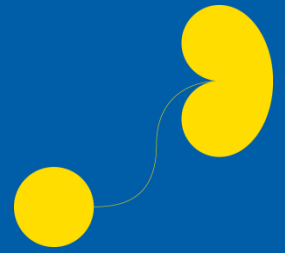


Be calm.

Be sure that drugs for first-line treatment are present – the same emergency drugs and instruments for X-ray and MR.



Fact



Radiologist and trainee knowledge of immediate life-threatening contrast reaction is deficient, e.g.:

- 53% of questions were answered correctly
- 43% knew the adrenaline dose
 - Incorrect doses were mainly too high doses
- 45% knew the emergency telephone number
- 45% of rooms did not contain an immediately visible chart for contrast reaction management



Easy access

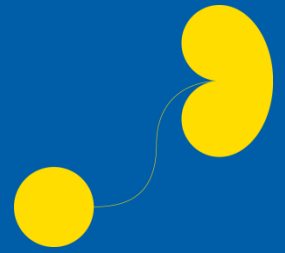
Everything can be in a trolley – remember

Report

Instructions



Adrenalin



Only one concentration (1:1,000) of adrenalin should be available in the radiology department to avoid confusion under stressful emergency conditions.

The 1:1,000 preparation should be given only intramuscularly.

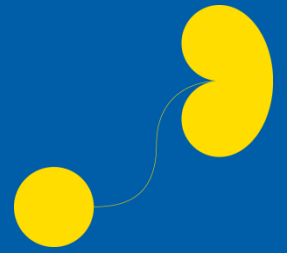
Intravenous administration of adrenalin by non-experienced staff can be dangerous.

Furthermore, dilution of adrenalin for intravenous use is time-consuming and would delay treatment.

REMEMBER $\frac{1}{2}$ ml i.m.



Fact



Survey of radiologists' knowledge regarding the management of severe contrast-material-induced allergic reactions.

Conclusion:

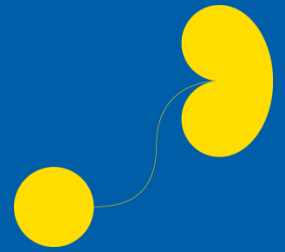
Radiologists' knowledge of epinephrine for the management of severe contrast-material-induced allergic reaction is deficient.

No radiologist gave the ideal response, but 41% provided an acceptable administration route, concentration and dose. Only 11% knew which concentration of epinephrine was available in their drug kit and/or crash cart and which equipment would be required to administer it to a patient.



Guideline

1.1.1. Acute adverse reactions to iodinated contrast media



Risk factors for acute reactions

Patient-related

Patient with a history of:

- Previous moderate or severe acute reaction (see classification above) to an iodinated agent
- Asthma
- Allergy requiring medical treatment

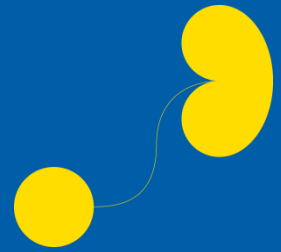
Contrast-medium-related

- High-osmolar ionic contrast media



Guideline

1.1.1. Acute adverse reactions to iodinated contrast media

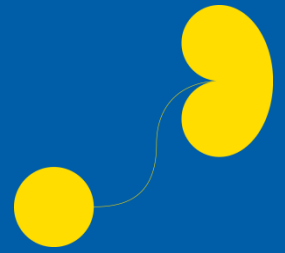


To reduce the risk of an acute reaction

| | |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| For all patients | <ul style="list-style-type: none">• Use a non-ionic contrast medium.• Keep the patient in the Radiology Department for 30 min after contrast medium injection.• Have the drugs and equipment for resuscitation readily available. |
| For patients at increased risk of reaction | <ul style="list-style-type: none">• Consider an <u>alternative test</u> not requiring an iodinated contrast agent.• Use a <u>different iodinated agent</u> for previous reactors to contrast medium.• Consider the use of <u>premedication</u>. Clinical evidence of the effectiveness of premedication is limited. If used, a suitable premedication regime is prednisolone 30 mg (or methylprednisolone 32 mg) orally given 12 and 2 hours before contrast medium. |
| Extravascular administration of iodinated contrast media | When absorption or leakage into the circulation is possible, take the same precautions as for intravascular administration. |

Guideline

1.1.2. Acute adverse reactions to gadolinium contrast media (non organ specific)



Risk factors for acute reactions

Patient-related

Patient with a history of:

- Previous moderate or severe acute reaction (see classification above) to an iodinated agent
- Asthma
- Allergy requiring medical treatment

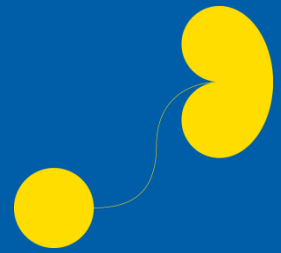
Contrast-medium-related

- The risk of reaction is not related to the osmolality of the contrast agent: the low doses used make the osmolar load very small.



Guideline

1.1.2. Acute adverse reactions to gadolinium contrast media (non organ specific)



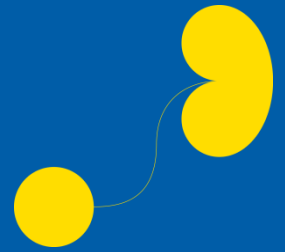
To reduce the risk of an acute reaction

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| For patients at increased risk of reaction | <ul style="list-style-type: none">• Consider an <u>alternative test</u> not requiring an gadolinium contrast agent.• Use a <u>different gadolinium agent</u> for previous reactors to contrast medium.• Consider the use of <u>premedication</u>. Clinical evidence of the effectiveness of premedication is limited. If used, a suitable premedication regime is prednisolone 30 mg (or methylprednisolone 32 mg) orally given 12 and 2 hours before contrast medium. |
| Extravascular administration of iodinated contrast media | When absorption or leakage into the circulation is possible, take the same precautions as for intravascular administration. |

Guideline

1.1.2. Acute adverse reactions to gadolinium contrast media (non organ specific)

The risk of an acute reaction to a gadolinium contrast agent is significantly lower than the risk with an iodinated contrast agent.



Guideline

2.1.3. Management of acute adverse reactions

First-line emergency drugs and instruments which should be in the examination room

Oxygen

Adrenalin 1:1,000

Antihistamine H1 – suitable for injection

Atropine

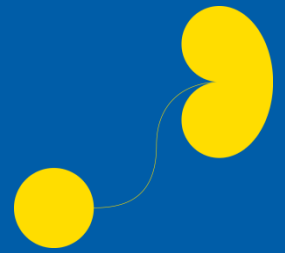
β 2-agonist metered dose inhaler

I.V. Fluids – normal saline or Ringer's solution

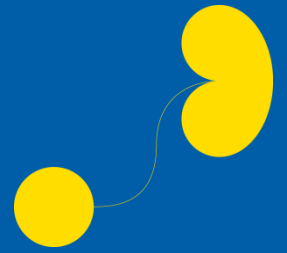
Anti-convulsive drugs (diazepam)

Sphygmomanometer

One-way mouth “breather” apparatus



Management of serious acute adverse reactions to contrast media

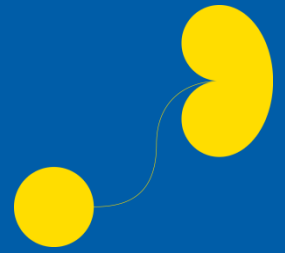


Laryngeal edema

- Oxygen by mask (6 – 10 l/min)
- Intramuscular adrenalin (1:1,000), 0.5 ml (0.5 mg), repeat as needed



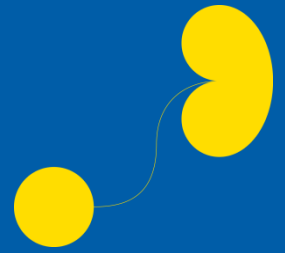
Hypotension and bradycardia (vaso-vagal reaction)



- Elevate patient's legs
- Oxygen by mask (6-10 l/min)
- Atropine 0.6-1.0 mg intravenously, repeat if necessary after 3-5 min, to 3 mg total
- Intravenous fluids: rapidly, normal saline or lactated Ringer's solution



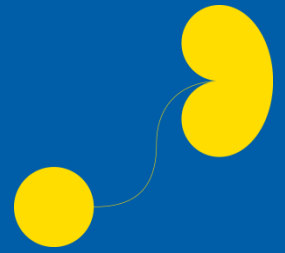
Isolated hypotension



- Elevate patient's legs
- Oxygen by mask (6-10 l/min)
- Intravenous fluid: rapidly, normal saline or lactated Ringer's solution
- If unresponsive:
adrenalin: 1:1,000, 0.5 ml
(0.5 mg) intramuscularly, repeat as needed



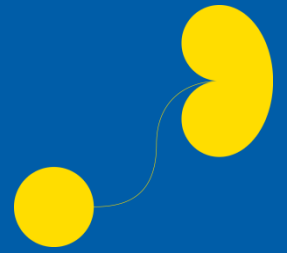
Generalized anaphylactoid reaction



- Call for resuscitation team
- Suction airway if needed
- Elevate patient's legs
- Oxygen by mask
(6 – 10 l/min)



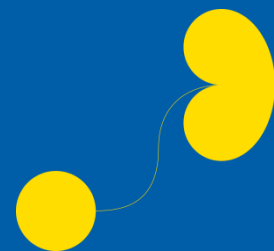
Generalized anaphylactoid reaction



- Intramuscular adrenalin (1:1,000), 0.5 ml (0.5 mg) in adults.
Repeat as needed.
- Intravenous fluids
(e.g. normal saline, lactated Ringer's)



ESUR Guidelines



For further details

