we are fortunate to have dr greg

dr seussler is currently the associate

director of medical information at

medimmune

received a pharmacy degree his bachelor

of pharmacy degree from the university

of connecticut and his doctorate of

pharmacy from the university of florida

and completed a critical care pharmacy

residency at the ohio state university

hospital

he spent the majority of his career as

the icu pharmacist at the nih

we hope you enjoyed todays lecture

good afternoon and welcome to todays

lecture on continuous journal

replacement therapy

this is a therapy typically used in

critically ill patients and intensive

care units

a difference it differs from

intermittent dialysis that is typically

used on an outpatient basis in people in

chronic renal failure

its important to understand the various

types of continuous renal replacement

therapy or crrt as its commonly known

if you go back it was a therapy first

discovered in germany in the 9 late

90s and at that time it was known as

scuff and scuff stood for slow

continuous ultrafiltration and that was

a form of replacement therapy that was

mainly used for continuous volume

removal in critically ill patients

that evolved over the next

four or five years to the early to mid

90s to a therapy known as cavh or

continuous arterial venous

hemofiltration and that was a modality

that the it was driven by the patients

blood pressure where you had one

catheter in a large artery such as the

femoral artery and you had another

catheter

located in the femoral vein for the

return of fluids back to the patient and

that was known as cavh and again that

was used maintained primarily for fluid

removal

as we progressed throughout the 0s we

added a counter current dialysis circuit

and so that became known as cavhd

so now you had solute removal via

convection and

diffusion

with the hazards of having large bore

catheters in large arteries such as the

femoral artery and in large veins such

as the femoral vein

they wanted to get rid of or wanted to

move to a less

invasive system so we evolved to see vvh

or continuous vino venous hemofiltration

where again it was continuous over

hours

the blood supply coming from the patient

was no longer a large artery but a large

vein typically the femoral vein

it was returned back to the patient in

this case also through the femoral vein

and again hemofiltration was just for

fluid removal

we then added counter current dialysis

to increase the efficacy of solute

removal

and then in the last 0 years weve

actually moved to a new therapy called

sled or a sustained low efficiency

dialysis and this is kind of a mix of

both a continuous form of dialysis but

instead of being over hours its

provided over to hours a day

making it somewhat more flexible for the

patient

in the intensive care unit

the indications for renal replacement

therapy is basically to remove excess

fluid in a fluid overloaded patient who

may be inuric

the clinical need to administer fluid

and someone in the icu typically

revolves around the administration of

parenteral solutions so that could be

parent or nutrition solution so that

could be parental or enteral we may be

administering one to two liters of

nutrition solution a day

the fluids associated with antibiotic

administration

of vasoactive substances such as lets

say dopamine or norepinephrine

blood products like packard cells or

platelets or something like that and

then other types of parenteral

medications that the patients may need

during their stay in the icu such that

the amount of fluid that youre giving

them

the body is not able to keep up with

urine output that you need to provide

additional therapy and thats where

continuous renal replacement therapy

comes in

the advantages of continuous strain

replacement therapy include hemodynamic

stability what you dont see with crrt

are the large

swings in blood pressure and volume

status that you get with intermittent

hemodialysis so you avoid the

hypotensive complications that you see

during intermittent dialysis and you

avoid the large intravascular volume

swings its easy to regulate the fluid

volume since the volume removal is

continuous over hours you can adjust

the rate of fluid removal on an hourly

basis so essentially you look at the

critically ill patients flow sheet look

what their volume status is

you look over the last hour last couple

of hours youll see what their volume

status is and you can adjust your rental

replacement therapy

to keep it in the range that you need it

to be

you can customize the replacement

solution so you can actually look at the

patients lab values and give back the

electrolytes to maintain normal

electrolyte ranges

based on the

the hemofiltration solutions or the

replacement solutions and you dont need

specialized dialysis nurses most icu

nurses can set up a renal replacement

circuit in about 0 to minutes

the advantages of sled again you avoid

the hypotensive complications that you

see with intermittent dialysis and you

avoid the intravascular volumes changes

that can occur

you also get high solute clearance so

you can remove a lot of solute so in a

sense you can really drop a bui in a

relatively short amount of time but the

nice thing about it is as as opposed to

cvdh or

cvvhd

which is continuous over hours you

can actually have relatively flexible

scheduling with sled you can schedule it

for to hours a day

you can schedule it around the patient

going to procedure lets say in

radiology where the patient go into the

operating room

you dont need the expensive crrt

machines you can use regular dialysis

machines that you may have in your

institution

you dont need the custom replacement

solutions although you can use them

based on the patients metabolic needs

and you dont need specialized support

staff again it can be run by

icu nurses

the disadvantage of continuous stream

replacement therapy is the lack of rapid

fluid and solute removal this is a

ratchet or a rather slow process that

occurs over hours or in the case of

sled to to hours

and the effective gfr is in the range of

about five to maybe 0 or 0 mils per

minute so you cant remove fluid and

solute quickly

it has a very limited role in an

overdose setting where you have to

remove a toxin thats been ingested

relatively quickly crrt is not going to

work theres some initial studies

looking at sled in the treatment of

overdoses but again those are still in

the early phases of the investigation

its unclear whether sled will be a

therapy to be effective in the setting

of overdose situations

and filter clotting one of the things

that happens as the filter

is on a patient for two three four days

or whatever

you begin to have blood proteins clot on

the filter reducing the efficacy of the

dialysis circuit or the hemofiltration

circuit you could look at that and see

the fact that youre not removing solute

as quickly

we could tell that by in a sense when i

would be monitoring immunity glycosides

in a critical ill patient lets say with

a new filter my genomizing clearance

might be in the range of about 0 to

mils per minute but as the filter got

older and you had the deposition of

blood proteins on the filter you

basically would clot off some of the

pores and you would see clearance

decline over a couple of days from maybe

the 0s to the mid0s

and the depending if it lasted too long

the clearance would drop down to the

upper teens

the basic principle ill show you a

graphic in a minute is blood passes down

one side of a highly permeable membrane

water and solute pass across the

membrane into an ultrafiltrate a

collection vessel

and solutes up to twenty thousand

dollars twenty thousand daltons can

easily be removed via crrt most drugs

and electrolytes are within this range

so theyre easily removable during this

process

you can infuse replacement solutions

with physiologic concentrations of

electrolytes to keep the patient

relatively stable from a metabolic

standpoint

and this is what a filter looks like

from a from a cartoon standpoint the

filter itself is probably the size of

maybe one and a half to two times a

paper cart paper towel roll so its

about maybe inches long and about

maybe three inches in diameter and what

you can see here on the right hand side

of the screen is a cross section of what

that filter looks like so the hollow

fiber membrane the little red area

thats those are the tubes that the

blood comes down and the fluid and

solute passes across the the red

membrane into the white area which is

the collection side inside of the

canister and then its eliminated out so

typically if you look at this the blood

is coming in from the patient typically

from the femoral vein theres a tube

that goes to the blood import and

theres an arrow identifying it as the

blood import

that it then passes along these

membranes to the blood outport

theres actually the the fluid and

solute basically goes across the

membrane and is eliminated into a

collection vessel hanging on the side of

the bed

in the setting here you see the blood

input is at the top of the canister and

the blood runs down the canister if you

look at dialysis on the left hand side

of the canister

the dialysate solution comes in from the

bottom it goes counter current to the

blood flow and it flows out the top of

the canister

into a collection vessel also on the

side of the bed

the basic principles of hemofiltration

are its based on convection or a

pressure gradient just imagine a leaf

blowing down the road

by the via the wind thats how basically

the solute passes through

human

its based on the trans membrane

pressure gradient so thats the

difference between the plasma oncotic

pressure or the pressure generated by

the blood proteins trying to keep fluid

inside the vascular space and the

hydrostatic pressure or the st or the

pressure pushing uh solute outside the

intravasc outside the intravascular

space

into the canister collection side

dialysis is diffusion based on the

concentration gradient so again the

solute goes from a high concentration

down to a low concentration trying to

achieve an equilibrium

this would be a typical cvvh circuit or

a continuous venovenous hemofiltration

circuit again if you look at the

canister you see blood is coming in from

the patient again typically the

femoral vein it flows into the top of

the canister

it flows through the canister in fluid

and solute goes across the membrane into

the yellow side

and it basically it flows out to a

collection vessel on the side of the bed

cvvh is based on convection so it goes

from an area of high pressure to low

pressure and again its that trans

membrane pressure gradient which drives

the solute removal

and also on the right hand side you can

see the replacement solution

the replacement solution can be

administered either on the blood from

the patients side or the blood

returning to the patients and it all

depends

if you put it on the side of the blood

in from the patient you actually dilute

out that blood coming from the patient

that lowers the transmembrane pressure

and that allows easier flow of the

solute into the waste side of the

canister

if you have it on the blood to patient

side youre actually diluting that

hemoconcentrated solu or blood now back

to the patient so its diluted out

before it goes back to the patient so

depending on the needs of the patient

and the efficacy of the human filtration

circuit you can have your replacement

solution and either on the inside or on

the outside

based on the needs

the primary goal of cvvh is basically

fluid removal through convection so or

solute removal based on convection so

the patient may not have they may have a

moderately high bun you want to remove

that they may have other electrolytes

that may be a little bit abnormal and

elevated and so mainly with convection

you can normalize those those values

also primarily its for the management

of intravascular volume so in that

patient whos flu fluid overloaded they

may have some degree of oliguria that

you need to infuse a lot of fluids but

they dont have the urine opera to keep

up with that youre going to use cvdh to

remove that excess fluid and whatever

solu solute you need to remove

the typical blood flow rate ranges from

0 to 0 mils per minute but a typical

starting range is about 0 mils per

minute and the ultrafiltration rate

range is between

and 0 liters for hours a typical

starting rate for the ultrafiltration

is about 00 mils per hour

it requires replacement solution to

drive convection so again if you have it

on the input on the blood inside of the

canister you dilute out the blood

proteins and you readily enhance uh the

the movement of solute from the blood

into the

collection vessel and for just

hemofiltration alone or cvvh alone you

dont require a dialysis solution so

youre able to manage the solute

with convection alone

what we have in this graph here if you

look at the y axis we have

ultrafiltration flow rate on the xaxis

we have trans membrane pressure and you

can see here that in the blue curve we

have a blood flow of 0 ml per minute

in the red curve we have a blood flow of

00 mils per minute and as you increase

the trans membrane pressure you actually

see that you increase the

ultrafiltration rate and as you increase

the pressure at a transmembrane pressure

of around 00 and

00 to 0

millimeters of mercury you begin to

plateau

so you really cant increase your

ultrafiltration rate anymore but if you

increase the blood flow if you increase

by another 0 ml per minute up to 0

mils per minute

you now see you can increase your ultra

filtration rate dramatically

going again at about a pressure of about

or so youve been a plateau

but at that pressure youve gone from

about 0 mils or 0 mils per minute up

to about 0 mils per minute so by just

increasing the flow rate of the blood

and delivering more blood to the

canister you can actually enhance your

ultrafiltration rate

this is now adding a counter current

dialysis so now we have cvvh

df or dialysate and so were looking at

solute removing solu removal now based

on convection and diffusion so in this

case we may be having a relatively high

bun we may have other electrolytes

that are significantly abnormal and you

have to remove them relatively

efficient effectively and convention

convection alone may not suffice so you

add in counter current dialysis and you

can see here

the right side is still the same but now

we have the dialysis solution going

counter current to blood flow where the

blood is coming into the top of the

canister and returning to the patient

from the bottom of the canister we

actually have our counter current

dialysis solution coming in from the

bottom of the canister and flowing to

the top

and again out to a waste collection

vessel

the primary goal here is solute removal

by diffusion and convection like i said

a moment ago where convection may not be

sufficient to remove the solute quickly

or to the greek the degree thats needed

we can actually add in uh diffusion with

dialysis and again of management of

intravascular volume so now it really

gives us the luxury of both moving

removing fluid and solute to a greater

degree than hemofiltration alone again

the typical blood flow rates are about

0 mils per minute to start off

were combining cvvh and cbvhd our

ultrafiltration rate again starting

rates about 00 mils per minute and

initial dialysis flow rates would be

about a liter per hour so that would be

a typical starting range for blood flow

for ultra filtration and dialysis and

then we can basically adjust it based on

how fast were removing fluid and how

fast were removing solute

to normalize lets say the solute and

metabolic profile

sled the primary goal again is just like

this before its both solute

removal by diffusion so again its a

form of dialysis not just human

filtration

and the management of intravascular

volume and here are the initial flow

rates typically blood flow and dialysis

flow rates are in the range of about 00

to 00 mils per minute

now the pharmacokinetics of renal

replacement therapy is similar to what

you would see in intermittent

hemodialysis now its important to

understand uh how effective

extracorporeal clearance

is going to be and you have to look at

it in in the sense of the total of all

forms of clearance whether its renal

nonrenal

or whatever and as a rule of thumb that

if the extracorporeal clearance its

contribution is greater than to 0 or

percent you will effectively remove a

drug or a solute like an electrolyte by

the extracorporeal therapy so in this

case um

the fraction of the extracorporeal

clearance is a function of the extra

corporeal clearance divided by the sum

of extracorporeal clearance residual

renal clearance and then nonrenal

clearance and again if the ratio is such

that the extracorporeal clearance is

greater than to percent you will

remove that drug from a patient

its not relevant for drugs with a high

neural clearance so drugs like morphine

beta law midazolam and things like that

that are effectively removed by the

liver because of blood flow to the liver

those drugs would not be expected to be

removed by a crrt circuit

and again its important to remember

that only drug thats not bound to

plasma proteins can be removed by

extracorporeal

procedures so its only the unbound

fraction of the free fraction thats

removed

now its important to remember in

critical illness that albumin declines

either because of reduced synthesis or

loss to the extravascular compartment

that the protein binding of drugs that

are bound to albumin may be changed and

the free fraction may be elevated and

those drugs may be effectively removed

during crrt on the other hand you have

acute phase reactant proteins that bind

to alpha acid glycoprotein thats

elevated during critical illness and

those drugs to bind to alpha one acid

glycoprotein may be

may be enhanced and the free fraction

may be reduced and you may not remove

that those drugs as effectively

the determinants of drug removal by crt

again of the drug itself

its the same as hemodialysis but you do

see an increase we

increase in the molecular weight of the

drugs that can be removed typically if

you look at some of the old dialysis

circuits vancomycin was not effectively

removed with some of the new circuits it

is and especially in crt you can

effectively remove vancomycin

during a dialysis session

the membrane so the permeability well

talk about the seedling coefficient in a

couple of more slides

the size of the membrane so again the

larger the membrane the greater the

surface area the more ability to remove

drug and well talk about the sieving

coefficient or the ability to cross

through the membrane

the renal replacement technique so

convention convection with or without

dialysis will enhance

drug removal

and the blood flow rates

the blood flow to the filter the

dialysis flow rate through the canister

and then the ultrafiltration rate

with the effective fluid removal from

the patient well all uh define how well

the drug will be removed and again the

duration the longer you hemofiltrate or

dialyze somebody the greater the amount

of drug and solute that will be removed

over the time period

so the seeding coefficient is just the

ability of the drug to pass through the
hemofiltration filter and it ranges from
zero to one its just the ratio of the
concentration of the drug or the solute
in the ultrafiltrate divided by the by
the concentration of the drug in the
plasma
and for a drug that for a filter thats
completely permeable to the drug or the
solute that the ratio would give you a
ratio or a seeding coefficient of one if
its something that was
totally impermeable and could not pass
through the filter the ratio would be
zero
such as a large blood protein or albumin
you would expect deceiving coefficient
to be zero so therefore the
hemofiltration clearance is just the
flow of the ultrafiltrate flow times
receiving coefficient and that gives you
hemofiltration
clearance
the determinants of the cv seeding
coefficient include protein binding and
again

only unbound drug passes through the

filter and again like i said a moment

ago protein binding changes in critical

illness may alter the ability to

partition across the filter

years ago in the early 0s and late

late 0s and early 0s there was a

number of studies looking at the ability

of drug to actually bind to the um to

the membrane and there was a number of

interaction studies that at the end of

the day it was felt that this is

relatively clinically irrelevant

but again its something that can occur

but its probably not anything thats

going to impact drug removal

and the absorption of proteins and blood

products onto the filter so again its

related to the filter age as the filter

gets older and you have more clotting on

the filter you see a decrease in the

efficacy

and the efficiency of solute removal so

if youre not reducing lets say your

bun or your phosphate is fast it may be

an indication that the filter is

clotting and again looking at

aminoglycoside clearance as a proxy

you can see that

when the filter is new you may be

eliminating aminoglycosides quite easily

but as the filter ages

you begin to see a reduced clearance

typically filters are changed every

three or four days its actually

mandated now

that they really cant go as long as

they used to be i once saw a filter last

seven days

but again thats been changed over time

relating to the clotting of the filter

ive seen filters clot as quickly as

within

to hours and typically these

filters have to be anticoagulated with a

heparin type product or citrate type

product to decrease the chances of

clotting

this graph shows you the function of the

relationship between unbound fraction

and sieving coefficient where you have

seeding coefficient on the yaxis you

have unbound fraction on the xaxis and

as you can see here as you increase the

unbound fraction you increase the saving

coefficient if you look up at the right

hand corner you can see drugs like

fluconazole imipenem procainamide

genomycin the typical antibiotics one

would use in an icu

all have very high unbound fractions

very low degrees of protein binding so

they have relatively high

seeding coefficients and readily

partitioned across

the circuit membrane

dialysis saturation this is just the

counter current dialysis flow

is always less than than blood flow you

can see here the ranges for a dialysis

flow is about 0 to 0 mils per minute

for blood flow typically in the range of

about to 00 mils per minute and this

really describes the equilibrium between

the solute in the blood and the

dialysate and think about it as youre

at the metro station and people are

standing on the platform and the metro

cars pull up the doors open people walk

onto the cars everybody has a seat the

door is closed and the train pulls out

and everybodys on a seat so its a

hundred percent um saturated with people

so to speak

and so diffusive clearance or dialysis

clearance basically equals to the train

flow rate and essentially um it will be

that way

now

this dialysis saturation is just again

the concentration of the drug and the

dialysate divided by the concentration

of the drug and the plasma and again

your ratio

will vary depending on the kind of

molecule youre talking about now things

will impact the dialysis saturation

increasing molecular size so the heavier

the weight of the molecule the slower it

takes to transport be transported across

the membrane into the dialysis solution

so large molecules partition relatively

slowly small molecules partition

relatively rapidly

and increasing dialysis flow rate the

faster the flow rate the less time there

is for equilibrium so going back to the

metro analysis where everybody is

standing on the platform the train cars

come out the door is open people start

to

walk from the platform into the cars and

all of a sudden the door is closed the

train takes off and again its not all

the seats arent filled at this time but

the train is going so fast its standing

for a lot less time at the station that

it cant be filled to capacity so again

it becomes less effective at higher

dialysis flow rates

dialysis clearance and again is recently

the dialysis flow rate times the

dialysis saturation

and this just shows you here here we

have a graph looking at clearance on the

yaxis and we have various dialysis flow

rates

on the xaxis so we have flow rates of a

thousand two thousand and twentyfive

hundred mils per hour and we have

compounds such as urea vitamin b and
inulin and as you can see here as you
increase from dialysis flow rates of a
thousand mils per hour you can see the
clearance rates and as you go up to 000
and then 00 mils per hour you increase
the clearance of each of these three
substrates so increase in dialysis flow
rate from a thousand to 00 or about
two and a half times youve almost
doubled the hemofiltration clearance or
human frustration dialysis clearance of
these compounds so again
by just increasing the dialysis flow you
can increase the clearance but again you
have you begin to have a tailing off in
its efficacy the faster you go
so then in sum total then extracorporeal
clearance here with crrt is basically
the summation of the hemofiltration
clearance which is just uh hemotropic
infiltration flow time seeding
coefficient plus the hemodialysis
clearance which is the dialysis flow
rate times the dialysis saturation rate
and that would give us our total

extracorporeal clearance

so heres a case history now this is the

patient actually was involved in here at

the nih clinical center a number of

years ago and this is a year old

hispanic male who was status post a bone

marrow transplant for aplastic anemia he

was admitted to the icu for management

of his acute renal failure

we started him on cvv hd so

hemofiltration plus dialysis for the

management of his uremia his icu course

was quite complicated by pulmonary

failure requiring mechanical ventilation

he had liver failure secondary to graft

versus host disease vinocleosis disease

and he also had sepsis

his infection was managed by genomycin

and vancomycin and his initial doses

were genomized in 0 milligrams every

hours in bank of mice on a gram every

hours

and his initial dialysis flow rate was a

thousand mils per hour and with that his

hour post genomics and level and

vancomycin levels were to and 0 to

milligrams per liter respectively and

he was stable at this regimen at this

dialysis rate

for about three or four days

his uremia worsened so we increased his

dialysis flow rate by 0 percent up to

00 mils per hour and then after that

our dialysis or hour post genomics

and vancomycin levels dropped

dramatically to less than 0 and less

than milligrams per liter respectively

these were validated in effect at this

dialysis flow rate these numbers were

consistent

over two days we subsequently increased

his doses to maintain therapeutic levels

but heres an example how a slight

increase in the dialysis flow rate had a

dramatic effect on his antibiotic levels

during therapy

so the question common commonly comes up

is like does a drug have to be

or will it be removed during either crrt

or sled so how can i determine a priori

if i have a patient come in at three

oclock in the morning where do i go to

look and what what can i look at just to

see if a drug could be removed by crt or

sled

well theres three parameters you can

look at and it will tell you essentially

how susceptible a drug is to removal the

first is if the protein binding is less

than 0 or 0 percent theres a good

chance the drug will be removed

if the volume distribution is less than

a liter per kilo it would be removed so

again if typically antibiotics are in

the range of about 0 to 0 maybe 0

liters per kilo so again they will be

effectively removed and if the renal

clearance is greater than percent

then those drugs will be removed well

what drugs fall into this category well

most of the antibiotics we administer to

critically ill patients are going to

fall into a protein binding less than 0

a vd less than a liter per kilo at a

renal clearance greater than percent

so it kind of tells you that those

antibiotics will be removed

well

thats great how often should i

administer the drug now

well if youre just doing hemofiltration

alone typically across most circuits the

effective gfr or glomerular filtration

rate will range from about 0 to 0

maybe 0 mils per minute for a

hemofiltration circuit alone

if you add in dialysis the gfr may be in

the range of about 0 to 0 mils per

minute and if you have sled the

effective gfr

is about 0 to 0 mils per minute so

knowing that your drug may be removed

typically an antibiotic may be removed

and knowing what kind of circuit you

have hemo filtration hemofiltration with

dialysis

or sled you can look into the package

insert or the pdr or whatever reference

you have and adjust the dose typically

in the range of about 0 to 0 mils per

minute for your circuit so that would

give you a great starting dose from that

standpoint

so

what other kind of dosing adjustments do

i need to do well from a loading dose

when you want to get the serum

concentrations therapeutic theres no

need to adjust the loading dose and

somebody on some form of continuous

renal replacement or sled

the loading dose depends typically on

the volume and distribution and if you

know that for your critically ill

population you can give them a typical

loading dose

for maintenance doses you can use

standard reference tables so again

depending on the type of circuit you

have and knowing what the effective gfr

is you can go to the pdr you can go to a

package insert you can go to the

formulary service and adjust the dose

based on that

you can do it based on the measurement

of losses or blood levels so again if

youre monitoring drugs such as

aminoglycosides or vancomycins or other

drugs that you can monitor via drug

levels you can adjust based on what your

drug level is now and where you want to

be with your replacement dose or you can

calculate the maintenance dose

multiplication factor the mdmf

so this is typically what we would have

used with aminoglycosides or vancomycin

you know what your target concentration

is so lets say for aminoglycosides

using conventional dosage and its

you know what your measured dose is

lets say its two you need to increase

the steering concentration by 0

milligrams per

liter then you know what the volume

distribute what the volume distribution

is you can calculate the dose you need

to give as a supplemental dose and you

can administer that to the patient

the other thing you can do is the

multiple the maintenance dose

multiplication factor so if you know

your extracorporeal clearance lets say

measuring uh how much drug is coming out

in the ultrafiltrate knowing what you

have through residual renal function so

if youre collecting urine and you

measure the drug in that if there is any

urine and then if appropriate you can

look at nonrenal clearance typically

from the literature and you can

calculate your mdmf using these

parameters

so what were looking at here is that

looking at the mdmf for intermittent

hemodialysis and crrt

that for a drug lets say like ceptazine

um in the looking at clearance and

nonrenal clearance with

a clearance of about mils per minute

a typical dose with somebody with a gfr

of about or a clearance of mils

per minute you might give them a gram

once a day or every hours

if theyre on intermittent hemodialysis

you would give them times that so

you would give them or grams

every hours and because continuous

renal replacement is much more effective

you would give them times that dose

of roughly to grams every hours

something like vancomycin

you might give them with a clearance of

six mils per minute you might give them

a gram once a day or so once every

couple of days that looking at the mdmf

for intermittent hemodialysis you might

give them 9 times that or roughly 9

grams or grams every couple of days

for crrt it would be 9 times that so

again you would adjust the dose

accordingly and something like with

vancomycin you would give them a dose

but you would monitor the levels and

adjust accordingly to give you your

trough levels that are clinically

relevant for that patient

the same thing by sled and crrt again

looking at linnaes lid for clearance of

about mils per minute if the patient

was on sled

instead of giving them 00 milligrams a

day you might give them 0 or maybe

rounding that up or so to 00 milligrams

a day if theyre on crt you would give

them basically 0 or maybe 900

milligrams

once a day based on the appropriate remo

appropriate amount of drug

based on its removal characteristics

something like imipenem or you might

give them a 00 milligrams sorry

muralpenum 00 milligrams once a day

with a clearance of mils per minute

you might give them 00 milligrams at

that same interval if theyre on sledder

if theyre on crrt

you might give them maybe a gram to

round it up from that standpoint

so in summary crt is a common continuous

dialysis

therapy thats used in critically ill

patients primarily for excess fluid

removal and excess solute removal

typically in patients who are anuric or

oligarch that have a requirement for

fluid administration typically through

antibiotics or vasopressors or nutrition

solution and have a need for fluid

removal i hope you enjoyed this lecture

i hope you found it informative if you

have any questions please forward them

to the

program administrator hell forward them

on to me and ill be happy to answer

questions for for you

through him thank you for your time

you